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The Montana energy conservation plan

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THE MONTANA ENERGY CONSERVATION PLAN

Submitted To

The Montana Energy Advisory Council

By

The Montana Energy and MHD Research and Development Institute, Inc.
P.O. Box 3809
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March 1977

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PREFACE

Governor Thomas L. Judge set the tone for the Montana Energy Conservation Plan in his energy message to the 45th Legislative Assembly on January 18, 1977. In that message, Governor Judge made the following statement:

> "During the last four years, Montana has become the nation's leader in design and enforcement of environmental safeguards. During the next four years, Montana should become the nation's leader in conservation of its energy resources and elimination of waste in their usage.
>
> At this point in our history, government must demonstrate its determination to reduce consumption of all resources -- fiscal as well as natural. The number one priority and the basic cornerstone of our energy policy must be reduction of energy demand; any other course is ultimately suicidal."

Simply stated, the intent of this project is to follow the lead of the Governor and create a plan which will make energy conservation the keystone of Montana's energy policy.

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I. PLAN INTENT

Introduction

The constraints of increasingly scarce energy affect all parts of the United States. Montana, like other states with a relative abundance of energy resources, is no exception and today must face critical questions regarding future supply. The presence of vast reserves of coal in Montana creates an illusion that somehow we are exempt from the need to ponder the consequences of future energy shortfalls. Coal currently cannot be used in many sectors of Montana's energy economy, and its massive long-range development may have important negative consequences. Meanwhile, two major current sources of energy -- natural gas and crude oil imports from Canada -- will be curtailed within a few short years. A sober assessment of this situation leads to the endorsement of conservation as immediately necessary if we are to attain energy self-sufficiency and are able to bridge the gap to a non-fossil fueled energy future. Under strong executive leadership and with the broad support of the Montana Legislature, the state intends to implement the strongest possible plan of energy conservation realizing that the example must come from a state whose non-renewable energy sources are in great demand.

This report focuses on specific methods of achieving an immediate reduction of energy use as a partial answer to a dwindling supply. It also recognizes the importance of building a long-range commitment to reliance upon renewable energy through acceptance of an ethic of energy conservation as a way of life for all

Montanans. Thus, great emphasis is placed upon creating a comprehensive and coordinated plan for involving all elements of Montana society in saving energy in every sector of current use. When implemented, the elements of the energy conservation plan outlined in this document will far exceed the requirements imposed in the Energy Policy and Conservation Act (P.L. 94-163) which addresses energy conservation in five areas: (1) lighting efficiency standards for public buildings; (2) car pools, van pools, and public transportation; (3) standards and policies for improving the energy efficiency of the procurement practices of the state and its political subdivisions; (4) thermal efficiency standards for new and renovated buildings; and (5) a traffic law which permits right turns on red after stop. The goal of the program is a 5 percent reduction in each state's projected 1980 energy consumption.

In Montana, the state's Energy Advisory Council is responsible for developing the state plan. The Montana Energy Advisory Council (MEAC) has decided to move well beyond FEA's five mandatory areas and study the possibilities for energy conservation in all sectors of Montana's economy -- both in the immediate and the long-term future. Montana's plan also will focus on replacing non-renewable with renewable energy sources to the maximum extent possible.

Since all Montana citizens will have to live with the energy conservation plan, public meetings were held throughout the state to review the plan as it was being developed. This report constitutes the Montana Energy Conservation Plan, based both on research and public involvement.

The approach used in this study was based upon what energy needs exist in Montana and how best to meet those needs.

Our first step was to analyze the waste associated with various energy uses. Eliminating this waste requires various kinds of conservation in our homes, businesses, cars and factories which will allow us to perform functions better, more efficiently, and with less energy. The next step involved a review of our current and future energy needs. These were divided into several categories:

(1) Low grade heat (under the boiling point of water) for space and water heating.

(2) Medium grade heat ($\lesssim 250^{o}$ C) for process steam and industry.

(3) High grade heat for industrial applications and electricity.

(4) Electricity for motors and lights.

(5) Liquid fuel for transportation.

When stated as above, it is less difficult to determine what needs must be met by what technologies. Space heating, for example, can be accomplished by using low grade heat from solar collectors or rejected heat from some industrial process. It does not make thermodynamic sense to burn valuable liquid fuel (vital for transportation) to provide heat with such low temperature requirements. This matching of energy quality to appropriate end use requirements utilizes the laws of thermodynamics. Maximizing thermodynamic efficiencies assures the best matching possible.

Initially, it is necessary to define energy conservation and the methodological framework used to develop our analysis. We define energy conservation as "the efficient utilization of energy". Energy conservation does not necessarily imply curtailment. We do not propose to conserve energy by closing Montana's industries or not heating Montana's homes. Instead, we propose to conserve energy by making equivalent amounts of energy do much more for us. This can be done by

substituting another resource (capital, skilled labor, time, careful workmanship) for energy; it also can be accomplished either by consuming less of or a different mix of the goods and services requiring energy. We do not view energy conservation and renewable energy development as being counter to Montana's economic development plans. Energy conservation will create jobs. Both energy conservation and renewable energy development are labor intensive rather than capital intensive since their application primarily is in decentralized small-scale and individual use. Most of Montana's homes and businesses need more insulation and should be weatherized more fully. The state's industries can purchase more energy efficient equipment. Solar heating devices can be manufactured and sold in Montana. Energy conservation and renewable energy development present excellent opportunities for both Montana business and labor.

A sincere commitment to these principles will guarantee a marked reduction in total energy consumption within the state, while actually enhancing other goals such as economic development, employment and environmental protection.

A fundamental assumption of this study is that energy conservation will be successful only if Montanans embrace the principle voluntarily and enthusiastically. To this end, major emphasis is placed upon programs of education and economic incentive. A significant responsibility ultimately is left with the private sector, under the assumption that Montanans will realize and will pursue energy conservation measures which assist them as individuals while contributing to the welfare of the entire state. Mandated measures are limited and are extended principally to activities of governments within the state on the grounds that leadership by example is the best method of promoting compliance.

The easy availability and low cost of energy in Montana has allowed us to defer important decisions regarding energy production and utilization. Government, business and citizens share this blinder vision. Now it is time to refocus together on the hard choices which confront us. We have vast quantities of coal, but also unlimited supplies of wind and sun. Shall we choose to spend the energy principal of non-renewable resources or live off the energy interest of renewable resources? A commitment to intensive energy conservation practices today will provide us with a larger margin of error for reaching a decision on future alternative energy tracks. To this end, the following report details the components of Montana's energy conservation plan.

Montana's Energy Consumption Patterns

According to the Federal Energy Administration (FEA), Montana consumed 340 trillion BTUs of energy in 1975. FEA projects that Montana's energy consumption will reach 370.5 trillion BTUs by 1980.

In 1974, Montana's gross per capita energy consumption was 440 million BTUs. This compares to a national per capita average of 340 million BTUs. Montana's high per capita consumption results both from the concentration of resource extractive industries within the state and Montana's large land mass and dispersed population. Per capita energy consumption in Montana grew at a rate of almost 3 percent per year in the 1960's. Between 1970 and 1973, Montana's per capita energy consumption grew at a 2 percent annual rate, and since 1973, energy growth

has slowed to less than 1 percent per year. Following is a sectorial breakdown of the energy consumption patterns within Montana.

Residential

The residential sector consumes about 15 percent of the energy used in Montana. Eighty-eight percent of this energy is used for space and water heating. The remaining energy is used to power lights and electricity. Two-thirds of the energy used in the residential sector comes from natural gas. The remaining energy use is broken down almost evenly between electricity and other sources such as propane and fuel oil.

Commercial

The commercial sector also accounts for about 15 percent of the energy used in Montana. Of this, about 75 percent is used directly in commercial buildings. In commercial buildings, about 62 percent of the energy used is for space heating and air conditioning. An additional 28 percent is used for lighting. Natural gas accounts for about 50 percent of the energy used in commercial building, electrici accounts for 35 percent, and the remaining energy is divided between fuel oil, coal and propane.

Industrial

Over the past decade, energy consumption in Montana industry has grown faster than the energy consumption of any other sector. Montana industries currently consume 35 percent of the total energy used in the state. Montana industry consumes over 40 percent of all natural gas sold within the state as well as over 60 percent of all electricity. In 1974, Montana industry consumed over 36 billion

cubic feet of natural gas. This energy use is concentrated in a few basic industries (mineral mining and processing, wood products and paper, oil refining, food products and cement). For example, in 1974, the Anaconda Company and Hoerner Waldorf together consumed over 40 percent of all the natural gas distributed to industry.

Agriculture

The agriculture sector accounts for 4.4 percent of Montana's fuel and electric usage, including the natural gas and oil required to produce needed fertilizer and pesticides. The production of crops in Montana accounts for 95 percent of the energy used in agriculture, while livestock production requires 5 percent. Fertilizer and pesticides manufacturing consumes 44 percent of the total energy used in crop production, and field operations and farm vehicles account for 56 percent.

Transportation

Transportation presently accounts for about 25 percent of the nation's direct fuel consumption. An additional 18 percent of the U.S. energy budget is used indirectly to build and maintain vehicles, construct roads, etc.

In contrast, Montana's transportation sector directly used 31 percent of the total energy consumed in the state in 1974. The use of motor gasoline in Montana has grown fairly steadily at an average annual growth rate of about 3 percent since 1950. The majority of the gasoline consumed in Montana in 1974 was produced at in-state refineries. Only 16 percent of the feedstock for Montana refineries was produced in Montana. Forty percent of the feedstock for Montana refineries currently is imported from Canada. This feedstock is scheduled to be eliminated in the 1980's, and replacement feedstocks have not been located yet. Gasoline consumption accounts for 73 percent of the energy used in the

transportation sector, highway diesel fuel accounts for another 9 percent, and the remaining 18 percent is used by railroads.

Government

The final energy consuming sector in Montana is state and local government. Government operations generally are included within the commercial and transportation sectors; but since Montana government has total control over its own energy consumption, we decided to address government operations separately.

Energy consumption in Montana government operations is substantial. For instance, in fiscal year 1975, 11 Montana state government building complexes consumed over 1.7 billion cubic feet of natural gas. Warm Springs State Hospital, where natural geothermal waters flow to the surface, consumed 212 million cubic feet of this total. Montana state and local governments also operate several thousand motor vehicles. Each year, the various Montana political subdivisions spend millions of dollars in various energy consuming procurements.

Montana governments have authority in the area of solid waste management. In the State of Montana, the energy equivalent of 50×10^{12} BTUs is processed as solid waste and used for land fill annually. This resource includes paper, glass, metals and plastics. In addition, another 1.7×10^{12} BTUs of fuel in the form of organic burnable wastes (food, grass clippings, etc.) is thrown away.

Montana state and local governments also are responsible for sewage treatment. The present system for sewage treatment considers sewage an undesirable waste product rather than a resource. In actual fact, the energy content of the sewage treated in Montana is about 1×10^{12} BTUs per year. This resource also has a fertilizer value in some applications.

The handling and purifying of these wastes require about 1.5 million BTUs per million gallons of sewage. For residential uses alone, the State of Montana consumes 3.2×10^{10} BTUs for sewage treatment. When industrial and commercial uses are considered, this figure triples. In addition, the technologies involved require great quantities of water which is in itself a scarce and valuable resource.

Energy Conservation Goal

The Federal Energy Administration estimates that Montana will consume 370.5 trillion BTUs of energy during the calendar year 1980. The goal of the FEA energy conservation program is a 5 percent reduction in this projected consumption level. Thus, to participate in the FEA program, Montana should propose projected 1980 energy savings of at least 18.53 trillion BTUs. As was noted in the introduction, Montana has chosen to move well beyond the five FEA mandatory areas and investigate energy conservation and renewable energy measures applicable to all sectors of Montana's economy. While Montana's plan focuses on both short- and long-term measures, particular emphasis was given to those measures which would have a significant and fundamental long-term impact. This plan was developed to make energy conservation and renewable energy a major long-term energy supply technology, not specifically to save 5 percent of Montana's 1980 energy consumption. Even so, this plan will exceed FEA's 5 percent goal and save a projected 23.93 trillion BTUs in calendar year 1980.

II. PLAN SUMMARY

Table II-1
Plan Summary

Program Measures	1980 Estimated Energy Savings (In Trillion BTUs)	Estimated Cost of Implementation (in $000's) 1977	1978	1979	1980
1. State Building Code and Thermal Efficiency Standards	3.63	90.0	20.0	20.0	20.0
2. Lighting Standards for Public Buildings	1.36	costs of implementation are included in Program Measure 1			
3. Procurement: Life Cycle Cost Analysis and Vehicle Fuel Efficiency Standards	.32	35.0	0	0	0
3a. Energy Managing, Auditing, and Retrofitting State Buildings	.75	200.0	500.0	250.0	250.0
3b. Renewable Energy Demonstration Project	Uncertain		Uncertain		
4. Right Turn on Red (Already in Force)	No Savings	0	0	0	0
5. Car Pool/Van Pool: Increase in Transit Level of Service	.05	1,226.0	206.0	6.0	6.0
5a. Public Transportation and Railroad Assistance Fund	1.50	12.5	25.5	50.0	50.0
5b. Bikeway Construction	.003	202.26	58.46	58.46	58.46
5c. Enforcement of 55 m.p.h. Speed Limit	2.23	0	0	0	0
6. Weatherization	.29	600.0	600.0	600.0	600.0
7. Conservation Loan Programs	1.80	50.0	50.0	55.0	55.0
8. Renewable Energy Tax Credit	.25	0	0	0	0
9. Public Utility Measures	6.99	100.0	50.0	100.0	100.0
10. Energy Conservation Education	4.29	204.0	172.0	230.0	230.0
Crude Oil Saving	.47				
TOTALS	23.933	2,719.76	1,681.96	1,369.46	1,369.46

III. DESCRIPTION OF PROGRAM MEASURES

Energy conservation will become an integral part of Montana's daily lives only when its benefits are perceived clearly. Individuals must be made aware of the significant economic and environmental advantages of saving energy from traditional sources in the short run and of shifting to alternative energy supplies in the long term. Energy consumption patterns can be changed in three basic ways:

1. Government can force compliance with standards, as in the case of fuel quotas, taxation for excessive use, or financial penalties.

2. Incentives can be provided to alter use patterns, as in the case of low interest loans for insulation or tax credits for industrial retrofitting.

3. Educational programs can address the multitude of energy saving techniques in virtually every category of energy end use in Montana.

Most of the specific implementation strategies involve either mandated or incentive programs or a combination of the two approaches. The following discussion provides definitions, examples and rationales for the two basic categories.

Mandatory Programs

Fuel allocation programs, rationing, and forced reduction of energy consumption are effective in saving energy under conditions of crisis. Mandatory programs like these sometimes are required, but they should be used sparingly

and in the proper circumstances. Mandatory programs may include direct compliance measures or severe tax sanctions, as in the case of greatly escalated gasoline taxes which could produce a shift to smaller automobiles. In either case, they run the risk of possible public antagonism and resistance which could damage the broader energy conservation program. For the most part, mandated measures have been confined to areas specifically required by the FEA and to other areas of government activity brought under direct control more easily.

Incentive Programs

Examples of incentive programs include tax subsidy measures, direct assistance such as weatherization, low interest loans, state assistance for energy audits, permissive legislation which could allow communities to experiment with alternative energy systems, and provision of matching funds for acquisition of federal monies. Incentive programs are appropriate when they stimulate the self-interest economic motive on the part of individuals. They are advantageous when they have an economic multiplier effect, as in the stimulation of jobs with the weatherization program. This approach should be maximized where short-term energy savings can be realized appreciably, as in the case of weatherization. Since publi resources are involved, programs should be chosen which have minimal bureaucratic costs for compliance and have the greatest potential for private sector economic ripple effect.

For both mandatory and incentive programs, there are associated important educational effects. The full range of educational programs are discussed as one implementation strategy. The following summary identifies the discrete program measures according to their primary nature as mandatory, incentive or educational.

Table III-1
Summary of Program Measures by Type of Program

Mandatory Programs

1. State Building Code and Thermal Efficiency Standards.
2. Lighting Standards for Public Buildings.
3. Procurement: Life Cycle Cost Analysis and Vehicle Fuel Efficiency Standards.

3a. Energy Managing, Auditing and Retrofitting State Buildings.
3b. Renewable Energy Demonstration Project.
4. Right Turn on Red.
5. Car Pool/Van Pool: Increase in Transit Level of Service.
5c. Enforcement of 55 m.p.h. Speed Limit.
9. Public Utility Measures.

Incentive Programs

5a. Public Transportation and Railroad Assistance Fund.
5b. Bikeway Construction.
6. Weatherization.
7. Conservation Loan Programs.
8. Renewable Energy Tax Credit.

Educational Programs

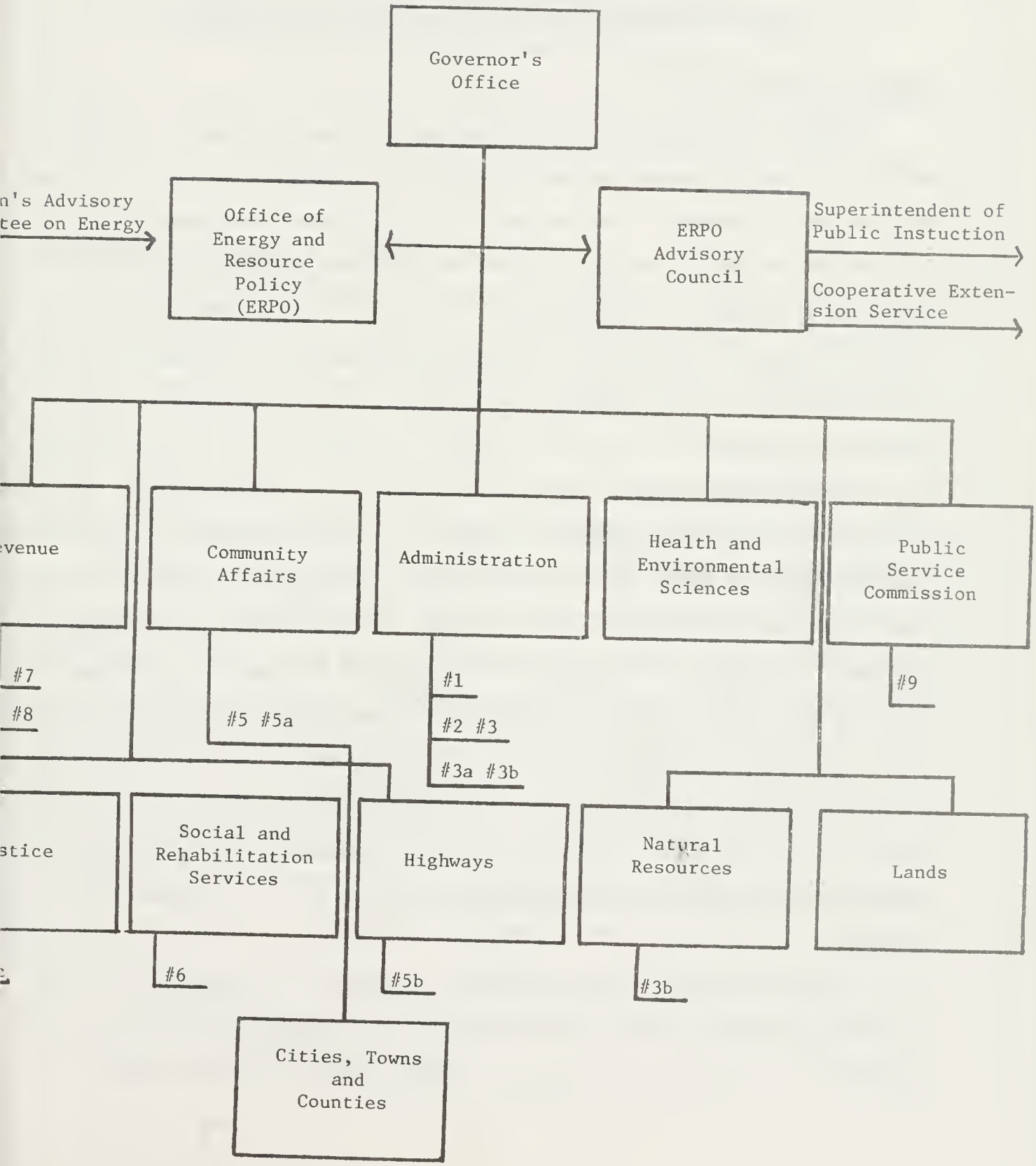
10. Energy Conservation Education.

It also is useful to identify program measures according to the principal energy use sectors which they address (see next page for a summary of program measures by sector).

Table III-2
Summary of Program Measures by Type of Program

Sector	Program Measure No.
Residential	1, 6, 7, 8, 9, 10
Commercial	1, 2, 7, 8, 9, 10
Industrial	9, 10
Agricultural	9, 10
Transportation	4, 5, 5a, 5b, 5c, 5d, 10
Government	3, 10

Figure III-1
Agency Responsibility Interactions
(By Program Measure)



Program Measure 1
Statewide Building Code and Thermal Efficiency Standards

Narrative Statement

Montana already has in place the necessary authority to comply with the objective of energy savings through elimination of excessive heat loss in all new and renovated buildings. State law contains building code requirements which call for building designs to take into account the efficient utilization of energy. An administrative mandate has been extended to the Department of Administration to adopt all or part of a nationally recognized building code. In compliance with FEA requirements, a 1977 legislative mandate has called for the immediate implementation of standards, at least as stringent as ASHRAE 90-75, to be in place for new and renovated buildings in advance of the January 1, 1978, deadline. The building code council has been mandated to conduct a technical evaluation of appropriate revisions of ASHRAE 90-75 and other code models. Revisions will include consideration of upgraded insulation standards, thermal shutters and direct solar gains as a minimum. A change in the character of occupancy of the use of any building or structure which requires an increase in either fossil fuels or electrical energy to heat or cool such building or structure is a renovation. Public hearings will be required for citizen input into the selection of standards and adoption of procedures for certification and enforcement. The Department of Administration is charged with fulfilling this and subsequent phases of the full implementation strategy.

Within four months of the passage of legislation, the Department of Administration will have drafted a code meeting the minimum standards but suited to Montana's particular weather conditions. Consultation with the Department of

Health and Environmental Sciences is mandated to insure consideration of environmental and health consequences of materials used for insulation. Following adoption of the code, the Department of Administration will develop a program of training and information for local building code officials prior to January 1, 1978.

Estimated Energy Savings for Calendar Year 1980

Using FEA supplied methodology and regional data, we calculate the 1980 energy savings from implementing thermal efficiency standards equivalent to ASHRAE 90-75 for new and renovated buildings in the residential and commercial sector amounts to 2.44 trillion BTUs. We assume that the building code will have been in effect for 3.25 years by the end of 1980, and then it will apply to 25 percent of the residential renovations and 50 percent of the commercial renovations.

The Ecotope Group of Seattle, Washington, in calculations developed for this study, has determined that the implementation of ASHRAE 90-75 likely will save on the order of 0.8 trillion BTUs in 1980 in the residential sector and that the combined lighting and building code standards for the commercial sector will save 2.6 trillion BTUs in 1980. They indicate that a more stringent standard in the residential sector (1" to 2" additional insulation in walls, 8" additional ceiling insulation, 6" floor insulation, storm window caulking and weatherstripping) could save approximately 1.2 trillion BTUs of additional energy. The major reasons for the slight discrepancy in results of the ASHRAE calculations is due to the fact that Ecotope has determined that new residential construction in Montana already nearly meets ASHRAE 90-75 and that Montana in general is not growing as rapidly as the rest of the Western United States.

To be internally consistent, we are attributing the energy savings calculated to this program measure using the FEA methodology. We note that an additional 1.19 trillion BTUs of energy will be saved in 1980 by adopting more stringent standards in the residential sector.

Thermal Efficiency Standards Program Measure

Goal

To adopt thermal efficiency standards for all new and renovated buildings at least as stringent as ASHRAE 90-75.

Objectives

1. To enact statewide energy conservation-related building codes by January 1, 1978.

2. To disseminate information and provide training programs necessary to implement, operate and enforce the program by January 1, 1978.

Current Status

Legislative action in 1975 authorized the Executive Branch to adopt a statewide building code based upon nationally recognized standards. There has not as yet been an appropriation to adopt such codes or any legislative action to set a time certain for implementation of proposed building codes.

Activities

1. Propose legislation requiring the Department of Administration to adopt building codes no less stringent than ASHRAE 90-75.

2. Administrative adoption of building codes by September 30, 1977.

3. Conduct a training and information program for local building code inspectors.

4. Monitor and revise energy conservation aspects of the building code.

Evaluation

1. By January 1, 1978, building codes will be adopted for all new and renovated buildings at least as stringent as ASHRAE 90-75.

2. By January 1, 1978, information and training programs will have been conducted for local building code inspectors.

Table III-3

MONTANA ENERGY PROGRAM

PROGRAM MEASURE TITLE: Thermal Efficiency Stardands

Goal: To adopt thermal efficiency standards for all new and renovated buildings at least as stringent as ASHRAE 90-75.

TASKS & MILESTONES	Calendar Year 1977				Calendar Year 1978				1979	1980
1. Draft building code law revisions.										
A. Draft	Complete									
B. Introduce	Complete									
C. Legislative Review		Enacted								
2. Prepare revised building codes.										
A. Draft			Complete							
B. Review				Complete						
C. Enact					Complete					
3. Provide training for local building code inspectors.										
A. Compile training materials.			Begin	Complete						
B. Develop training courses.			Begin	Complete						
C. Conduct training workshops				Begin	Continue	----------	----------	----------	----------	----------
4. Initiate sample audit of compliance						Begin		Complete	Continue	----------
5. Review, revise and update building codes.									Review	----------
TOTAL COST				$90,000				$20,000	$20,000	$20,000

Table III-4
Costs of Implementation
(Includes Costs for Program Measure 2)

1977	$20,000	Draft Code
	$70,000	Training of Code Inspectors
1978	$20,000	Monitor Code
1979	$20,000	Monitor Code
1980	$20,000	Study Code for Possible Revision

Program Measure 2
Lighting Standards for Public Buildings

Narrative Statement

Lighting efficiency standards will be included within the building code program described under Program Measure 1. The same implementation strategies and target deadlines apply. The state will use a standard no less stringent than in Section 9 of ASHRAE 90-75 as the minimum standards for lighting efficiency in both new and existing public buildings. The lighting standard will apply to all public buildings over 10,000 square feet.

The milestone chart (see Table III-3) for Program Measure 1 also applies to Program Measure 2.

Estimated Energy Savings for Calendar Year 1980

Using FEA methodology and regional data supplied by FEA, we calculate that 1.36 trillion BTUs of energy will be saved in calendar year 1980 by implementing this program measure. We assure that the standard will have been in effect for 3.25 years and that all the floor space of new buildings will be affected, along with half the floor space of existing buildings.

Costs of implementation are included in the costs for Program Measure 1 (see Table III-4).

Lighting Efficiency Standards
Program Measure

Goal

To adopt lighting standards no less stringent than those of Section 9, ASHRAE 90-75.

Objectives

1. To enact legislation applying to all public buildings above a certain size no less stringent than Section 9, ASHRAE 90-75 by January 1, 1978.

2. To disseminate information and provide training programs necessary to implement, operate and enforce the program by January 1, 1978.

Current Status

Same as Thermal Efficiency Standards status.

Activities

Same as Thermal Efficiency Standards activities.

Evaluation

Same as Thermal Efficiency Standards evaluation.

Program Measure 3
Procurement: Life Cycle Cost Analysis and Vehicle Fuel Efficiency Standards

Narrative Statement

The public sector provides broad opportunity for substantial energy savings. State and local governments utilize large amounts of energy, directly in operations, and indirectly through the purchase of buildings, equipment and materials. Governments, like private citizens, have not been inspired by the need to eliminate wasteful energy use until quite recently. This program measure will make energy conservation a salient principle of daily government activities and will produce significant direct savings. In addition, the example set by government should serve indirectly to promote savings in the private sector by providing exemplary patterns for emulation by businesses.

The state is in a current stage of physical plant growth. The capitol building complex is under expansion, and additions or renovations are being made to numerous public facilities, including university campus buildings, state hospitals and detention facilities. This period of new construction should be made to symbolize a state policy of long-term investment in energy conservation and renewable energy. Under provisions of proposed legislation, the Department of Administration is charged with adopting a uniform design and procurement procedure which includes life cycle cost analysis and analysis of payback periods for energy conservation over the effective life of buildings and equipment. The state's financial commitment to the operation and maintenance of public owned facilities for the duration of their useful lives permits the adoption of construction options which require ten or more years of fuel savings before net

economic savings are realized. Accordingly, the state is best situated to consider longer life cycle cost periods.

The Department of Administration will create an inventory of all classes of equipment and materials to be covered under the life cycle cost procedure, but the categories must include (at a minimum) all new buildings, motor vehicles, computers and print reproduction equipment. The Department of Administration is required to adopt the most recent standards produced by efforts such as those of the General Services Administration and the National Bureau of Standards. At a minimum, however, the following considerations are required of the life cycle cost standards for buildings:

1. Fuel cost escalation and total fuel cost inflation rate, interest rate, and discount rate over the life of the equipment or buildings.

2. Cost of maintenance (including labor and materials) and operation over the life of the equipment or building.

3. The orientation and integration of the facility with respect to its physical site.

4. The amount and type of glass employed in the facility and the directions of exposure.

5. The effect of insulation incorporated into the facility design and the effect on solar utilization of the properties of external surfaces.

6. The variable occupancy and operating conditions of the facility and subportions of the facility.

7. An energy consumption analysis of the major equipment of the facility's heating, ventilating and cooling system, lighting system, hot water system, and all other major energy consuming equipment and systems as appropriate. This analysis shall include (1) the comparison of alternative systems; (2) a projection of the annual energy consumption of major energy consuming equipment and systems for a range of operation of the facility over the life of the facility; and (3) the evaluation of energy consumption of component equipment in each system, considering the operation of such components at other than full or rated outputs.

The Department of Administration will be provided resources for preparing the life cycle cost analytical procedure, including costs of programming computer software necessary for the analysis and supporting personnel and computer time required in the evaluation process. The Department of Administration will have the evaluation procedure in place by January 1, 1978, and will supervise its application to relevant state agencies thereafter. Application to local governments will not be mandatory, except in cases where state funds are used for public building construction. Rather, the Department of Administration will work with the Department of Community Affairs to promote mechanisms through which local governments can avail themselves of the life cycle cost procurement procedure and can enter joint purchase agreements with the state to maximize cost savings. The Department of Administration will promote communication of all energy saving procurement techniques both within state government agencies and between state and local governments.

The Department of Administration also will be given explicit authority to require the purchase of state vehicles with average fuel efficiency levels in the upper one-third of the U.S. Environmental Protection Agency's city/highway rating scale. This mandate will apply to all passenger vehicles purchased by any state agency (except Montana Highway Patrol purchases of law enforcement vehicles) beginning July 1, 1977.

In addition, the Department of Administration will conduct the purchase inventory studies necessary to comply with all other FEA procurement requirements.

Estimated Energy Savings for Calendar Year 1980

The major energy savings which will occur under this program measure will be in the area of new state building construction. Ecotope projects that 2 million square feet of new construction will occur in the government and institutional sector by 1980. For this analysis, we will assume that 25 percent of this construction will occur each year between 1977 and 1980. We again will assume that design contracts for construction in 1977 and 1978 already have been let and no design changes are possible. We will assume that 50 percent of the construction that is projected to occur in 1979 and 1980 will fall under the life cycle cost analysis program (500,000 square feet). We will again assume that a life cycle cost purchasing decision could save 25 percent of the energy consumed in a new building (split equally between fossil fuels and electricity) or 62,500 BTUs per square foot. Thus, we project total energy savings of approximately .07 trillion BTUs in 1980 for building procurement alone.

The state motor vehicle fuel efficiency procurement policy also will save energy. Although exact records have not yet been compiled, it appears that over 10 million vehicle miles are traveled annually by state-owned passenger vehicles. The state fuel economy standard requires that American made vehicles be purchased which are in the top one-third of the combined EPA city/highway mileage standard. Since all motor vehicles will meet a 20 mile per gallon standard by 1980 under federal regulations, only those fuel economy gains above 20 miles per gallon can be credited to this program. If we assume that under this program measure the state passenger car fleet will have an average fuel economy of 25 miles per gallon, a total of .25 trillion BTUs of gasoline will be saved in 1980.

Energy saving through life cycle cost procurement will occur in many other areas; however, insufficient data exist to quantify the savings.

Procurement Practices
Program Measure

Goal

To develop mandatory standards and policies to effect energy efficient procurement practices within the state and its political subdivisions.

Objectives

1. To enact legislation requiring performance of a life cycle cost analysis before any state agency may lease or construct a facility by January 1, 1978.

2. To enact legislation requiring the purchase of state vehicles with average fuel efficiency levels in the upper one-third of the EPA city/highway rating scale by January 1, 1978.

3. To survey the state purchasing system to evaluate the technical and organizational resources available for implementing energy conservation in all procurement practices by January 1, 1978.

Current Status

To date, the most visible energy conservation procurement activities are focused on vehicle fleet purchasing. There presently is no standardized procedure for assessing procurement practices in relationship to energy efficient products.

Activities

1. Developing procedures for life cycle cost analysis to implement pending legislation.

2. Adopt vehicle efficiency standards and monitor comparable fuel saving performance.

3. Conduct workshop for state offices involved in purchasing for information interchange and collaboration.

Evaluation

1. Life cycle cost legislation will be enacted by January 1, 1978.

2. Vehicle fuel efficiency standards will be enacted by January 1, 1978.

3. A communication network will be established among all state purchasing systems to insure that energy conservation performance data is rapidly exchanged among agencies.

MONTANA ENERGY PROGRAM	**Goal:** To develop mandatory standards and policies to effect energy efficient procurement practices within the state and its policital subdivisions.

TASKS & MILESTONES	Calendar Year 1977				Calendar Year 1978				1979	1980
1. Conduct survey of state purchasing system.		Begin			Complete					
2. Develop and disseminate procedures for life cycle cost analysis.										
A. Prepare			Begin			Complete				
B. Dissemination							Begin	Complete		
3. Revised procurement practices available to state and local governments.									Begin	Complete
4. Procurement practices initiated by state and local governments.										Begin
TOTAL COST				$35,000						

Table III-6
Costs of Implementation

1977	$35,000	Computer Programming Software
1978		
1979		
1980		

Program Measure 3a
Energy Managing, Auditing, and Retrofitting State Buildings

Narrative Statement

The commitment to life cycle cost analysis in designing and constructing new state buildings is a symbolic beginning in the public sector with far-reaching results. Other measures must be instituted to achieve present direct savings in the operation of state government buildings. Some programs can be implemented immediately to eradicate fuel wastage. A number of these will be included under the broad program title of energy management in state buildings. The components of this program include the following:

1. Energy auditing in existing state buildings for determination of significant energy savings potential.

2. Implementing energy management practices with the existing network of buildings.

3. Implementing conservation retrofitting in state buildings on a priority basis as established by the audit program.

Under the energy audit program, from 250 to 300 state buildings would be selected to identify operational and structural modifications capable of reducing energy demands with a minimum disruption of ongoing functions. The energy audit program will develop a standard evaluation methodology which can be utilized by administrators of state and local buildings not selected for the audit sample which, nevertheless, could benefit from analysis. Efforts should be made to encourage the participation of the private sector for the purposes of assisting in designing the audit procedures and promoting widespread use of the completed audit procedure in the private sector. Under the terms of proposed legislation, an appropriation of $200,000 would be made to conduct the energy audit.

While it is expected that the energy audit program will provide valuable suggestions for both structural and operational modifications of buildings, a program of energy management does not need to await results of the audit. Immediat savings can result from implementing known techniques which require little additional resource outlay. Simply educating maintenance personnel and building users in the efficient management of thermostat settings, illumination levels, hot water control, equipment maintenance, and ventilation can achieve short-run savings. More significant savings can accrue from small expenditures for minor retrofitting devices such as flow reduction water faucets, double door entrances, and added insulation and weatherstripping. Many of these changes can be made in the absence of the energy audit and should be encouraged in all state buildings.

To accomplish these energy savings, Governor Judge has issued an executive order requiring the Department of Administration to specify and put into effect more efficient management practices in the operation of existing state buildings. Such measures could save on the order of 15 to 30 percent of the energy use in existing buildings.

Major retrofitting will occur in those buildings discovered by the energy audit to be in greatest need and capable of producing the most savings at the lowest cost of retrofitting. As in the case of life cycle cost procurement, the state is in a good position to make important leadership contributions since the state owns its buildings and can afford the years necessary to recapture the investment cost. As a large fuel consumer, the state must adopt this hedge against the inflation of fuel costs and must show private citizens the advantages of doing so themselves. Under the terms of proposed legislation, an appropriation of $500,000 would be made for the acquisition and installation of

conservation materials. A portion of this funding would be set aside for the program of energy operations management, including informational and educational materials as well as minor retrofitting equipment and supplies.

Estimated Energy Savings for Calendar Year 1980

Both the energy auditing program with its accompanying retrofit appropriation and the energy management program will produce almost immediate energy savings in government operations. Ecotope projects that 1.7×10^7 square feet of government floor space will be in existence in 1980. The average energy consumption of government buildings in Montana works out to be 250,000 BTUs per square foot per year. Thus, energy consumption in government buildings in 1980 is projected to be 4.25 trillion BTUs. If 60 percent of the buildings (floor space) in the government sector are audited and implement the Governor's executive order and each save a projected 20 percent of their energy consumption due to implementing energy conserving operating procedures, a total of .51 trillion BTUs of end use energy will be saved in 1980. If we assume that 80 percent of these savings will be fossil fuels and 20 percent electricity, actual energy savings from implementing this measure will be .748 trillion BTUs using FEA methodology. These savings will be accomplished with a capital investment of less than $100,000.

The energy auditing and retrofit program will produce energy savings in addition to those calculated above. It is projected that approximately $900,000 in state funds will be available for implementing energy conservation procedures disclosed through the auditing procedures. Ecotope estimates that energy savings on the order of 50 percent can be accomplished for (at most) approximately $3.00 per square foot in existing buildings. Thus, $900,000 will retrofit approximately

.045 trillion BTUs in 1980. This assumes that the retrofitting will be applied to the worst energy-consuming buildings and will save 150,000 BTUs per square foot. Total savings in state government building operations thus are projected to be approximately .753 trillion BTUs in 1980.

Energy Managing, Auditing and Retrofitting Program Measure

Goal

Significant reductions of energy budget costs experienced by state agencies.

Objectives

1. Implementation of fundamental energy management techniques in all state facilities through executive order by July 1, 1977.

2. Establish a system for carrying out energy audits of existing state buildings by January 1, 1978.

3. Design energy management programs for buildings which have been audited by April 1, 1978.

4. Implement conservation retrofitting in state buildings on a priority basis as established by the audit program by July 1, 1978.

Current Status

Since the Arab oil embargo in the Fall of 1973, there have been numerous attempts to increase consciousness of energy use within state government. Prospects for drought and therefore reduced hydroelectric generation capacity make renewal of these efforts a high priority item in the short run. Physical modification and improvement of state facilities to conserve energy is a medium- to long-term activity.

Activities

1. Prepare checklists and procedures for implementation of the executive order by June 15, 1977.

2. Review other state and federal governments for potential sources of technical assistance in establishing energy audit system.

3. Seek funding to provide in-service training on energy management to persons responsible for carrying out procedures in audited buildings.

4. Advocate for increased priority for energy conservation measures in long-range building plan.

Evaluation

1. Issuance of executive order followed by 10 percent reduction in energy use in state facilities for a period of at least six months.

2. System of auditing state buildings by January 1, 1978.

3. Designation of a energy conservation coordinator in each state facility serving more than 50 people.

4. Designation of 10 top payoff investments for retrofit by April 1, 1978.

Table III-7
MONTANA ENERGY PROGRAM

PROGRAM MEASURE TITLE: Energy Managing, Auditing and Retrofitting

Goal: Significant reductions of energy budget costs experienced by state agencies.

TASKS & MILESTONES	Calendar Year 1977				Calendar Year 1978				1979	1980
1. Develop and introduce energy management requirements.	Begin	Failed							Reintro-duce	
2. Develop and implement an energy management program in state government.		Begin			Complete					
3. Develop energy audit procedures for state buildings.										
A. Draft			Complete							
B. Test			Complete							
C. Finalize				Complete						
4. Conduct energy audit program.					Begin	Continue	----------	----------	----------	----------
5. Initiate minor retrofitting practices.					Begin	Continue	----------	----------	----------	----------
6. Initiate major retrofitting program.									Complete	Continue
TOTAL COST				$5,000						

Table III-8
Costs of Implementation

1977	$100,000	Energy Audit.
	$100,000	Energy Management and Minor Retrofitting.
1978	$100,000	Energy Audit.
	$400,000	Retrofitting.
1979	$250,000	Retrofitting.
1980	$250,000	Retrofitting.

Program Measure 3b
Renewable Energy Demonstration Project

Narrative Statement

In addition to the direct savings resulting from changes in energy use patterns of the state government, the potential demonstration effect of state activities for private behavior is quite large. Because of the great diversity of both renewable and non-renewable energy sources in the state, a number of projects could be undertaken to illustrate the fact that Montana is, by no means, locked into traditional energy use patterns. Even though certain projects might not be cost effective in the short term themselves, they are worth supporting for their value in stimulating public awareness of the wide range of innovative energy sources that currently are possible both in technological and economic terms.

Serious consideration has to be given to creating model projects in more than one energy use sector. Solar heating of a highly visible state building is one possibility. Another realistic project might be the conversion of the Warm Springs State Hospital to geothermal heat as part of a renovation of that facility. Therefore, it is recommended that the state undertake a research and development effort to consider the geothermal adequacy as well as the costs, practicability and possible environmental impacts of a geothermal project at Warm Springs. If found to be advantageous, the state should accomplish the conversion task immediately. If Warm Springs State Hospital were converted to geothermal energy, at least .25 billion cubic feet of natural gas would be conserved. The State of Montana also has an opportunity (some would argue "obligation") to convert its other building complexes from natural gas to some other energy source. In many cases, coal would be the most economical choice; however, coal's polluting characteristics must be considered fully before any conversions are undertaken. The State of Montana has a tremendous reservoir of talent within the university system. The universities should take the lead in developing innovative solutions to natural gas supply problems. Many state building complexes are in areas with sizable potential for the implementation of renewable energy resources. This potential should not be ignored.

Estimated Energy Savings for Calendar Year 1980

The extent of energy savings from this program measure obviously depends on the degree to which conversions are effected. Feasibility studies alone will save no energy. Because we cannot recommend a specific appropriation for conversion at this time (the 1979 Legislature must address this), we presently cannot attribute any direct energy savings to this program measure.

Costs of Implementation

The costs of implementation are uncertain. The state may be able to conduct these evaluations by redirecting existing resources. Long-term savings may be the actual result.

Renewable Energy Demonstration Program Measure

Goal

Determine the potential of utilizing renewable forms of energy to replace non-renewable energy forms in the State of Montana.

Objectives

1. Publish and distribute 2,000 copies of the Montana Renewable Resources Handbook by July 1977.

2. Through the energy audit and management program, determine the most appropriate renewable energy form for selected state buildings by April 1, 1978.

3. Develop potential funding plan for conversion to renewable forms of energy for each building selected based upon local, state and federal funding sources by July 1, 1978.

4. Prepare and distribute to legislators a study assessing both the initial and life cycle costs of converting ten large-scale state buildings to renewable energy forms by January 1, 1979.

Current Status

With its own state funded research and demonstration program on renewable energy technology, Montana is already in a leadership position in the United States. Efforts by private organizations such as the Alternative Energy Resources Organization's New Western Energy Show and the local Human Resource Development Council workshops on solar hot water heaters and solar reliant greenhouses have made renewable energy sources more visible in Montana. However, adoption of renewable resource technology for meeting the needs of public buildings will require more education and design work.

Activities

1. Review and comment on draft of Montana Renewable Resources Handbook.

2. Seek support from units of higher education in assessing potential of audited buildings for application of renewable resource technology.

3. Establish connections between persons responsible for long-range building program and appropriate officials in HUD, FEA and ERDA.

Renewable Energy Demonstration
Program Measure Cont'd.

4. On basis of audits and preliminary design work, convene a committee to select ten buildings for nomination to Legislature.

Evaluation

1. Review of Handbook by at least three major newspapers and eight weekly's.

2. Prepare suggestions for most appropriate alternative form of energy in state audited buildings.

3. Completion of designs and cost benefit proposals on ten buildings by October 1, 1979.

Table III-9
MONTANA ENERGY PROGRAM

PROGRAM MEASURE TITLE: Renewable Energy Demonstration

Goal: Determine the potential of utilizing renewable forms of energy to replace non-renewable energy forms in the State of Montana

TASKS & MILESTONES	Calendar Year 1977				Calendar Year 1978				1979	1980
1. Develop and print Montana Renewable Resources Handbook.	Begin	Complete								
2. Develop coordinated effort relating to applications in the State Building Program.			Begin			Complete				
3. Prepare specific recommendations relating to ten state building for renewable forms of energy concept.							Begin		Complete	

Program Measure 4
Right Turn on Red

Narrative Statement

Montana has a "right turn on red" traffic law enacted July 1, 1975 (RCM 32-2137):

> "Vehicular traffic facing the signal shall stop before entering the crosswalk on the near side of the intersection of, if none, then before entering the intersection and shall remain standing until green or "Go" is shown alone or until a right turn can safely be made and in making such turn vehicular traffic must yield the right-of-way to pedestrains lawfully within the crosswalk and to other traffic lawfully using the intersection. If a traffic sign legend indicating that no right turn on red may be made after a stop is posted at said intersection, such movement cannot be made until green or "Go" is shown alone."

Because Montana has a "right turn on red" traffic law, estimates of milestones, energy savings and implementation costs are not applicable.

Program Measure 3
Car Pool/Van Pool: Increase in Transit Level of Service

Narrative Statement

The transportation sector in Montana offers considerable prospect for energy savings because of the high percentage of total energy use it constitutes. At the same time, it must be remembered that reduction in fuel use is quite difficult in a highly rural state where transportation is a critical link between dispersed pockets of population. The greatest opportunity for savings in the mandated

program measures in transportation lies in the more urbanized areas where incentives are necessary to increase the number of persons per vehicle. In response to FEA requirements, two Montana cities with urban area populations of between 50,000 to 100,000 have been selected for car pool/van pool matching campaigns (Billings) and increased levels of transit service (Billings and Missoula).

Both car pooling and increased levels of transit service can produce direct energy savings and the residual benefits of reduced peak hour traffic congestion, air pollution, and transportation for the aged or disabled. But habits associated with the use of private automobiles are difficult to break and may require time to alter. The program measures described here would be most effective under conditions in which complementary measures (such as increased motor fuel taxes or increased parking fees) were imposed. Nonetheless, it is possible to show net energy savings from car pooling and mass transit if imaginative and aggressive promotional programs are implemented. Four additional Montana urban areas have submitted demonstration project responses to the Federal Urban Mass Transit Act (UMTA), and other communities have initiated voluntary car pooling projects, which are indications of the potential for energy gains from broadening these programs.

A plan exists for implementing a car pool system for Billings and only requires sufficient funding to be in place by January 1, 1978. Funds to support the program have been proposed in the Emergency Highway Energy Conservation Act, available initially to the communities on a 90/10 federal/state match basis.

The plan for increasing the transit level of service in Billings calls for significant increases in service and ridership based on a reduction of headway

time from 45 minutes to 20 minutes. The increased level of service is dependent upon the purchase of new buses. A bill in the current legislative session would provide state matching of capital grant funds under UMTA for purchase of equipment by local governments. Upon receipt of funding, this program could be in operation within one year and fully implemented by 1980.

Voters in Missoula approved creation of a metropolitan transit district to provide service within the incorporated area. The plan provides for establishment of a core system in 1977 and expansion in subsequent years (through 1980). The savings attributable to this initiation of transit service are comparable to the increase expected in the upgrading of the Billings program. Both the Billings and Missoula expanded transit level of service programs are coordinated through their respective local metropolitan planning organizations.

Estimated Energy Savings for Calendar Year 1980 -- Billings Car Pool

Assuming that ten percent of the working force participates, it would result in a reduction of 12,836 vehicle miles of travel per day in Billings, which amounts to 237,120 gallons/year or $.02964 \times 10^{12}$ BTUs/year. Applying the annual growth rate in gasoline consumption of three percent (reflecting both the increased number of miles driven and participation in the car pool program) would give a total savings of $.0353 \times 10^{12}$ BTU. Because of the estimated small savings, the "Guidelines for Travel Demand Analysis of Program Measures to Promote Carpools, Vanpools and Public Transportation", prepared for the Federal Energy Administration by Cambridge Systematics, Incorporated, was not used to calculate the potential energy savings. The City of Billings conducted a comprehensive car pooling analysis which is used for this analysis.

Billings chose to use the FHWA Computer Matching Program to match travel data and participant requests. There are approximately 42,800 employees in the Billings urban area. The average roundtrip to work is six miles. The following assumptions were used to calculate the energy savings:

1. 1.2 commuters per vehicle in rush hours.
2. 10 percent of total employees join car pool.
3. 13 miles per gallon of fuel consumed.
4. 3 commuters per vehicle in car pool.
5. 98 percent of the employees in cars.

Estimated Energy Savings for Calendar Year 1980 -- Billings Mass Transit

Two methods were used to project the possible energy savings of this program measure: "Guidelines for Travel Demand Analysis of Program Measures to Promote Carpools, Vanpools and Public Transportation", and BTU analysis from data provided by the Billings transportation planners. The first procedure would yield a savings of $.061 \times 10^{12}$ BTUs/year, whereas the latter projects a savings of $.00673 \times 10^{12}$ BTUs/year. The latter number is in the same magnitude as that calculated for the Missoula bus system and is the more conservative figure. Thus, the remaining analysis is based on this projection.

Only the persons served by the bus route were included in the analysis. This included 87,000 persons served with an average of 2.7 persons per household. Assume that 1.1 workers per household yields 35,444 potentially affected workers. The remaining assumptions were used in calculating with FEA guidelines:

1. Total ridership per day would increase from 1,500 in 1975 to 21,00 in 1980.

2. The number of bus miles traveled per day to decrease headway would increase from 1,500 miles per day in 1975 to 2,000 miles per day in 1980.

3. Six mile roundtrip.

4. 13 miles per gallon per auto.

5. 8 miles per gallon per diesel bus.

Estimated Energy Savings for Calendar Year 1980 -- Missoula Mass Transit

Based on data provided by the Missoula City Planning Office, the bus system implemented by 1980 would have an energy savings of $.0065 \times 10^{12}$ BTUs/year. Translated into gallons of gasoline, the system would yield a savings of 51,864 gallons of gasoline.

Based on the number of miles traveled per year by the bus system and the number of persons riding provided by the Missoula City Planning Office, the energy savings was computed. Assumptions included the following:

1. 447,668 miles traveled per year by bus in 1977.

2. 24,700 persons used the bus per year in 1977.

3. The ridership and bus mileage remained constant through 1980.

4. 13 miles per gallon per auto.

5. 8 miles per gallon per diesel bus.

Note the total savings is .048 trillion BTUs in 1980.

Car Pools, Van Pools and Public Transportation Program Measure

Goal

To promote the availability and use of car pools, van pools and public transportation.

Objectives

1. To provide assistance to the City of Billings in soliciting funds for institution of car pool program by January 1, 1978.

2. To provide technical assistance to City of Missoula to initiate a mass transit program by January 1, 1978.

3. To survey potential funding sources available to support expansion of existing mass transit systems in Billings by November 1, 1977.

Current Status

The only car pool/van pool activity with a major thrust is just now beginning in the Glendive area. This program involves a central telephone agency that tracks out-of-city travel by community residents and encourages ride-sharing.

Activities

1. Provide technical assistance to City of Billings in developing car pool program.

2. Provide technical assistance for personnel responsible for Missoula mass transit program.

3. Identify and mobilize appropriate expertise within state government necessary to support the expansion of ongoing mass transit service in Billings.

4. Collect and monitor annual gasoline consumption data -- update Montana historical energy statistics publication.

Evaluation

1. By January 1, 1978, a car pool program will have been initiated in the City of Billings.

2. By January 1, 1978, a mass transit service will be available to residents of Missoula.

3. Pre- and post-usage surveys in Billings and Missoula areas.

Table III-10

MONTANA ENERGY PROGRAM

Goal: To promote the availability and use of car pools, van pools and public transportation.

TASKS & MILESTONES	Calendar Year 1977				Calendar Year 1978				1979	1980
1. Review current state car pool/ van pool programs.		Begin		Complete						
2. Develop model car pool/van pool mass transit program for initiation in Montana cities.										
A. Initiate Missoula mass transit.					Complete	Continue	----------	----------	----------	----------
B. Initiate Billings car pool.					Complete	Continue	----------	----------	----------	----------
3. Develop a public awareness program to support newly initiated programs.				Begin	Complete	Continue	----------	----------	----------	----------
4. Evaluate increased usage of car pool/van pool and mass transit by means of a survey.								Begin	Complete	
TOTAL COST				$5,000				$6,000	$6,000	$6,000

Table III-11
Costs of Implementation
(Includes Costs for Program Measure 2)

	Billings Car Pool	Billings Mass Transit	Missoula Mass Transit
1977	$26,000		$1.2 million (capital costs only)
1978	$6,000	$200,000	
1979	$6,000		
1980	$6,000		

Program Measure 5a
Public Transportation and Railroad Assistance Fund

Narrative Statement

The energy efficiency of well utilized public transportation and railroad passenger and freight service offers prospects of substantial energy savings if a significant portion of transit needs now met by private automobiles and motor freight carriers could be assumed by the urban public and railroad transportation modes. Large shifts to these efficient alternatives to the private internal combustion vehicle are unlikely in view of the totally inadequate level of service and convenience currently offered by these transportation systems.

Years of neglect and under-utilization of these systems have been aggravated and abetted by the enormous public subsidy of the interstate, state and local highway system and related services such as police patrol, traffic control systems, and public parking facilities. There has been a pervasive presumption that the public interest is best served by government actions which increase the speed, accessibility, geographic range and convenience of private automobile and truck transportation. This preoccupation with private on-demand mobility has seriously impaired the capability of other transit modes to support Montana's transportation requirements. Because of the single focus policy, Montana's economic health and social diversity lean upon an energy supply which is extremely vulnerable to curtailments and disruptions over which the state has little or no control.

If Montana hopes to re-establish a balanced and diverse transportation system necessary for future prosperity and viable communities, it must be willing to invest significant capital and operational expenses to gradually resuscitate

a severely atrophied rail system and also be willing to initiate and support urban transit systems for short distance, high volume passenger trips. Public response to these transportation improvements are likely to be slow as engrained attitudes regarding cars, convenience and speed adjust to emerging fuel constraints and price inflation. Deficit operation of many public transit and rail services is to be expected during the beginning years of establishing public confidence in, and use of, these systems. Without assuming the responsibility for providing energy efficient transportation alternatives now, Montana cannot expect to be spared the consequences which will beset a society whose mobility is almost totally dependent on the fluctuation of foreign suppliers of petroleum.

In view of this need for immediate preparation of a multi-purpose transportation system, we recommend that the Gasoline Distributor's License Tax (levied at 7-3/4¢ per gallon, effective July 1, 1977) be increased by 2-1/4¢ per gallon, with the revenues being deposited to the account of a Public Transportation and Railroad Assistance Trust Fund. The monies in this fund would be administered by the state's Department of Community Affairs, which currently has authority for public transit programs and is to be designated the lead agency for Montana's railroad planning and assistance program. Eligible appropriations from this trust fund would be for (1) state grants to local governments for public transit planning; (2) state capital grants to local governments to match federal Urban Mass Transportation Act funds (80/20 federal to state and local matching ratio) for public transit vehicles, equipment and facilities; (3) state subsidies for up to half of a local public transportation program's operational deficits (as currently authorized by R.C.M. 11-4513); (4) state planning, subsidization and capitalized

implementation of a statewide rail service program as developed in compliance with the federal Railroad Revitalization and Regulatory Reform Act; (5) state grants for planning, capitalized implementation and operational support of innovative, energy efficient transportation demonstration projects; and (6) expenses incurred by the department for planning, implementing and evaluating the statewide public and railroad transportation programs.

The fund would receive approximately $9 million (2-1/4¢ per gallon x 422,233,150 gallons per year) from revenue generated in the 1978-1979 biennium if the tax were to go into effect by July 1, 1977. While these are not insignificant sums of money, they are a modest proportion of the funds allocated to the Highway Trust Fund (approximately $65,446,200). It also must be recognized that there is a pressing need for state financial assistance to public transit and railroad service maintenance at this very moment.

Perhaps more than 100 miles of railroad lines within Montana have been abandoned in the last few years. There is strong speculation that a 43-mile stretch of rail service between Vaughn and Augusta (Lewis and Clark and Cascade Counties) may be discontinued within the year. There also is the prospect of the Milwaukee Railroad Company merging with Burlington Northern (Milwaukee's petition for permission to merge currently is before the Interstate Commerce Commission). Under federal railroad reorganization rules, merged railroad companies can discontinue rail service along one of their combined lines whenever they are roughly parallel. Since most, if not all, of Milwaukee's rail lines are in this parallel category with Burlington Northern's service, the potential impact of discontinued rail service throughout the southern portion of Montana is severe.

A large portion of rail freight demand comes from Montana farmers who must move millions of bushels of grain and other products to markets each year. When rail haulage of this harvest is curtailed or discontinued, farmers have little option but to switch to motor freight carriers. Not only are motor carriers less energetically efficient than rail freight, the increased requirements and wear and tear of rural road systems would require substantial expenditures of state highway trust funds to upgrade roadways for this increased motor carrier use.

Maintenance and eventual expansion of rail freight service in Eastern Montana is particularly significant if the state is to pursue a policy of exporting coal for out-of-state energy demands. Sustaining and extending local rail service may be desirable if Montana chooses to encourage in-state, small-scale load center coal conversion to electricity, district heating, and residential heating. Transporting coal for industrial co-generation and local utility service would be assisted greatly by a functional rail system.

The case for assistance to urban public transit programs also is strong for the 1978-1979 biennium. The City of Missoula recently established an urban transit district and now is purchasing buses to begin implementing its public transportation plan. The consolidated local government of Butte-Silver Bow is seriously considering the establishment of an urban transit district, and Billings needs to improve upon its public bus service. Currently, all capital expenditures necessary to begin such public transit programs (and to acquire 4 to 1 federal UMTA matching funds) must come from the local governments. With the full weight of capitalized expenditure upon local communities, the capability of beginning with an adequate level of public transit service is weakened.

Furthermore, while the state is authorized to subsidize up to one-half the local public transit operational deficits, the actual assistance levels have been substantially less than this upper limit. There also is a problem of state payments coming at the end of the year in which the deficits occurred, while the local government must cover the costs on a continuing basis. We endorse the Department of Community Affairs' recommendation that the state provide operational funding assistance at the beginning of the year based on estimated deficits or during the year as deficits are incurred (perhaps on a quarterly basis).

Estimated Energy Savings for Calendar Year 1980

Energy savings under this program measure will occur from both reduced demand due to increased gasoline prices and from the direct energy savings from increased levels of public transportation and other innovative transportation measures.

It has been documented that an increase in the price of gasoline will cause a decrease in its demand. Assuming a "best case" estimate, a 1 cent increase in gasoline price would give a 1 percent fuel savings in 1980. Using a 3 percent annual growth rate in gasoline consumption, 1980 gasoline consumption is projected to be 66.8 trillion BTUs. Thus, it is estimated that 1.5×10^{12} BTUs would be saved in 1980 by the enactment of this indirect measure.

The direct energy savings accompanying this measure cannot be quantified at this time. All the specific programs that would be adopted have not been enumerated yet.

As one specific example of the potential direct energy savings from this program, we shall consider the Vaughn-to-Augusta rail line. Approximately 2,557 tons of agricultural or livestock products were hauled over this line in 1972.

If this transportation is done by truck with an energy use of 2,400 BTUs per ton mile, the energy usage would be 2.639×10^8 BTUs. Whereas, if the same load was hauled by train with an energy use of 750 BTUs per ton mile, the energy demand would be $8,246 \times 10^7$ BTUs. Assuming the same level of production in 1980, the yield would project savings of $.00018 \times 10^{12}$ BTUs.

Public Transportation and Railroad Assistance Program Measure

Goal

Implementation of innovative, energy efficient public transportation and freight systems in the State of Montana.

Objectives

1. Passage of legislation increasing the Gasoline Distributor's License Tax earmarked to an account for public transportation and railroad assistance by April 1, 1977.

2. Seek funds to establish a transportation technology assessment capability within an appropriate state agency by January 1, 1978.

3. Raise and focus public and private concern over future transportation issues and potentials through public forums during the Fall of 1977.

4. Carry out necessary activities to implement intent of legislative resolutions on expansion of Amtrak service by October 1, 1977.

Current Status

Abandonment of rail lines threatens to become a major problem in Montana. General deterioration, the possibility of a major merger between Burlington Northern and Milwaukee, and infrequent or under-utilization of some lines are among the factors which may contribute to a substantial reduction in rail freight service. Transfer of the freight service now carried by these routes to trucking would increase the state's already high consumption level of energy for transportation.

Activities

1. Introduce legislation providing for an earmarked tax and fund for public transportation and railroad assistance.

2. Work with Traffic Safety Division and other interested organizations and agencies to develop a proposal for a transportation technology assessment office.

3. Ask current railroad interests to disclose their future plans regarding abandonment and confer with neighboring states about impacts of these plans on energy consumption.

Public Transportation and Railroad Assistance
Program Measure Cont'd.

Evaluation

1. Adoption of legislation by July 1, 1979.

2. Completion and submission of proposal to appropriate funding agencies by October 1, 1977.

3. Communication with railroad interests, shipping interests, and neighboring states by August 1, 1977.

4. Publication of study detailing benefits of expanded Amtrak service by December 1, 1977.

5. Survey public issues and increased usage patterns by January 1, 1978.

MONTANA ENERGY PROGRAM	Goal: Implementation of innovative, energy efficient public transportation and freight systems in the State of Montana

TASKS & MILESTONES	Calendar Year 1977				Calendar Year 1978				1979	1980
1. Develop and introduce legislative program.	Introduced	Failed							Reintro-duce	
2. Relating to Railroad Assistance Act, develop an energy savings evaluation methodology.			Begin		Complete					
3. Develop a transportation technology management capability in state government.									Begin	
4. Monitor public and private concerns on transportation issues/ Governor's forums.		Begin						Complete		
5. Survey public issues and increased usage patterns.					Begin	Continue				
TOTAL COST				0						

Table III-13
Costs of Implementation

	Administrative Costs	Additional Tax
1977	$12,500	$4.75 million
1978	$25,500	$9.5 million
1979	$50,000	$9.5 million
1980	$50,000	$9.5 million

Program Measure 5b
Bikeway Construction

Narrative Statement

As with many other energy conservation program measures, the promotion of bikeways has a dual set of benefits. Not only is bicycling an energy efficient mode of transportation, it is a package of positive externalities. It is less expensive, often more convenient, usually more healthful, and certainly more compatible environmentally than its chief rival -- automobiling. Based on testimony in public hearings throughout Montana's urban areas, it appears that a significantly greater incidence of bicycling would occur if bicycle paths were established to help reduce the hazards of competing with other traffic. Immediate goals in Montana are to develop bikeways in four of the larger urban areas: Miles City, Missoula, Billings and Great Falls. Funding would come from state highway construction funds if the Legislature clarified previous legislation providing that 3/4 of 1 percent of the funds be spent for creation of footpaths and bicycle trails.

Estimated Energy Savings for Calendar Year 1980

Extensive local energy saving calculations have been performed for potential bikeways in Miles City, Billings, Great Falls and Missoula. The combined plans are projected to result in over 163,000 fewer vehicle miles per day traveled in these cities. The total savings from implementing bikeways in these four cities is .0032 trillion BTUs.

Bikeway Construction
Program Measure

Goal

Implementation of innovative energy efficient personal transportation systems in Montana.

Objectives

1. Legislative clarification of eligibility of bikeways construction as an activity fundable by the state Highway Department by April 1, 1977.

2. Assuming determination of legislative eligibility, facilitate efforts by local governments to design and implement bikeway systems by January 1, 1978.

3. Document successful bikeway programs carried out by local governments to serve as a guide to other local governments by June 1, 1978.

Current Status

Interest in bikeway construction and designation exists in several Montana communities -- Missoula, Helena, Miles City, Billings, etc. -- however, progress has been stimied by a question about the eligibility of bikeways as a fundable item by the state Highway Department.

Activities

1. Seek documentation from other states on eligibility of bikeway projects in preparation for legislative clarification.

2. Distribute materials documenting successful bikeway development projects carried out in other states to interested local governments.

3. Provide on-site technical assistance to efforts by local governments to develop bikeway programs if necessary and requested.

4. Publish a monograph on bikeway status in Montana prepared under the supervision of the Citizen's Advisory Committee on Energy.

5. Develop self evaluation program for participants, evaluation forms on post- and current gasoline consumption.

Evaluation

1. Passage of legislation clarifying eligibility of bikeways for DOT funding.

2. Provision of assistance to at least two local governments by May 1, 1978.

3. Greater awareness among local elected officials of the potential of bikeways to ease traffic problems and cut energy consumption, through the media

4. Public surveys to determine increased usage patterns by February 1978.

MONTANA ENERGY PROGRAM

MONTANA ENERGY PROGRAM

Goal: Implementation of innovative energy efficient personal transportation systems in Montana.

TASKS & MILESTONES	Calendar Year 1977				Calendar Year 1978				1979	1980
1. Continue current state bikeway construction program.	Continue									
2. Document current successful bikeway programs in the U.S.A.			Begin		Complete					
3. Assist local governments' bikeway planning programs.			Begin	Continue						
4. Conduct public surveys in selected areas relating to increased usage of bikeways.					Begin	Complete				
TOTAL COST				0						

Table III-15
Costs of Implementation */

	Miles City	Missoula	Billings	Great Falls
1977-1980	$26,800	$117,000 (in hand)	$166,400	$64,440

*/ To be funded from a combination of gasoline tax, bicycle license fees, sale of maps, federal grants from Bureau of Outdoor Recreation and highway safety funds.

Program Measure 5c
Enforcement of 55 M.P.H. Speed Limit

Narrative Statement

Numerous studies have documented well the two-fold advantage of the nationwide 55 mile per hour speed limit: overall fuel savings and reduction of fatal accidents. Nonetheless, it remains true that penalties for violation have failed to produce uniform compliance with the speed standard. In Montana, a combination of extensive open road and inconsequential fines has produced a substantial percentage of violators. Based on 1976 Montana Highway Department data, more than 60 percent of drivers on state highways exceeded the limit (broken down as follows):

31.8 percent	55-60 m.p.h.
19.0 percent	61-65 m.p.h.
7.7 percent	66-70 m.p.h.
3.8 percent	70+ m.p.h.

Strict conformance to the 55 mile per hour speed limit could produce significant savings by 1980. It has been shown that automobiles traveling at 60 m.p.h. consume 5 percent more fuel per mile than those traveling at 55 m.p.h. The corresponding figures for reductions back to 55 m.p.h. are 13 percent for 65 m.p.h. and 20 percent for 70 m.p.h. Thus, immediate savings are likely since more than half of Montana's drivers would be affected. It should be noted that stricter enforcement of the limit may alter the behavioral pattern of only a portion of the drivers (perhaps two-thirds) and that resentment to the imposition may produce some non-quantifiable costs of compliance. A public information program should focus first upon greater voluntary compliance, especially during the portion of

the year when the nation's fuel shortages are dramatized by the winter's cold. However, enforcement can change behavior (i.e., perception of risk in being caught).

Immediate enforcement with stricter fines will not require any additional manpower, vehicles or radar costs on the part of the Montana Highway Patrol. The exact fine mechanism and structure will be determined by the 1977 Montana State Legislature.

Estimated Energy Savings for Calendar Year 1980

Approximately 75 percent of the vehicle miles traveled in Montana are on roads with a posted 55 m.p.h. speed limit. Using data supplied by the Montana Highway Department and the Montana Highway Patrol, we calculate that if everyone in the state obeyed the 55 m.p.h. speed limit, 2.83 percent of the energy used in transportation could be saved. In our analysis, we assume that strict enforcement of the 55 m.p.h. speed limit would cause two-thirds of the drivers in Montana to change their behavior and obey the speed limit. This would result in a 1980 projected energy savings of 2.23 trillion BTUs.

55 M.P.H. Speed Limit
Program Measure

Goal

Increase public understanding and awareness of the relationship between energy consumption, safety and speed.

Objectives

1. Passage of legislation providing increased penalties for exceeding 55 m.p.h. speed limit by April 1, 1977.

2. Develop a public information program emphasizing the potential savings and safety benefits of 55 m.p.h. speed limit by July 1, 1977.

Current Status

Legislation has been introduced to strengthen Montana's current 55 m.p.h. speed limit. Currently, over two-thirds of the drivers using Montana highways are exceeding the 55 m.p.h. speed limit.

Activities

1. Propose legislation requiring more stringent penalties for exceeding current 55 m.p.h. speed limit.

2. Through news releases, speaking engagements and development of informational materials, make public aware of need for respecting 55 m.p.h. speed limit.

Evaluation

1. Adoption of legislation requiring more stringent penalties by July 1, 1977.

2. Preparation of six news releases, ten public speaking engagements, and two informational packets by November 1, 1977.

3. Conduct speed studies to determine the changes in actual speeds driven by Montana motorists (out-of-state vehicles will be excluded from sample).

Table III-16

MONTANA ENERGY PROGRAM

PROGRAM MEASURE TITLE: Enforcement of 55 M.P.H. Speed Limit

Goal: Increase public understanding and awareness of the relationship between energy consumption, safety and speed.

TASKS & MILESTONES	Calendar Year 1977				Calendar Year 1978				1979	1980
1. Develop legislative revision relating to speed limits in Montana.	Begin	Partial Pass							Reintro-duce.	
2. Develop and initiate a public awareness program relating to 55 M.P.H. speed limit.			Begin	Initiate	Continue----------					
3. Evaluate performance of increased effort (speed limit studies).				Complete				Complete	Complete	Complete
TOTAL COST				$15,000						

Table III-17
Costs of Implementation

1977	0
1978	0
1979	0
1980	0

Program Measure 6
Weatherization

Narrative Statement

The federal government's cooperative weatherization program already has proven to be an effective method of reducing heat loss in Montana homes. Approximately 2,000 homes have been upgraded with demonstrated energy savings ranging from 15 to more than 40 percent of previous energy consumption levels (depending on the quality of the existing construction). Still, nearly 30,000 additional low income households in the state are eligible for energy conservation renovations through the program. The state is committed to a significant expansion of the weatherization program in order to reach a substantial number of these homes. The results will be an immediate documentable energy savings together with a needed reduction of the burden of rapidly rising heating costs upon those in Montana who are least able to afford them. The extensive state commitment is justified further by the availability of federal weatherization funds from the Community Services Administration at a 60 to 40 match ratio and under Title 20 of the Social Security Act, a 3 to 1 match ratio.

The state will utilize $150,000 per year for FY '78 and FY '79 to generate an approximate additional $450,000 per year in federal funds. This commitment amounts to an approximate tripling of the resources of the existing program. Implementation of the program will be done within the existing framework of joint administration by the Department of Community Affairs and the Department of Social and Rehabilitation Services. The combined federal and state weatherization funds will be allocated to local weatherization programs on both a formula

and project basis. One-half of the funds will be disbursed to local programs according to the incidence of eligible households, and the remaining one-half will be allocated on the basis of local matching effort. Yearly allocations will be made, and both the Department of Community Affairs and the Department of Social and Rehabilitation Services will review local program performance prior to approval of subsequent funding requests.

Estimated Energy Savings for Calendar Year 1980

If the weatherization program is continued through 1980, at least $2.4 million will be made available. Labor funds allocated from other sources (CETA, for example) will increase the value of the weatherization program even further. Local data indicate that weatherization will cost a maximum of $400 per house for an average energy savings of 20 percent. Thus, if we assume that 8,000 homes are weatherized through this program and that each house reduced its energy consumption by 20 percent, .29 trillion BTUs will be saved in 1980. We assume that the low income houses likely to be weatherized are both smaller (1,000 square feet) and less adequately insulated (180,000 BTUs per square foot per year) than the average Montana home.

Weatherization
Program Measure

Goal

Minimizing the impact of rising energy costs on persons with limited and low incomes.

Objectives

1. Passage of legislation providing increased matching funds necessary to expand ongoing weatherization program by April 1, 1977.

2. Increase interagency coordination to insure mobilization of all available resources for weatherization in an integrated fashion by July 1, 1977.

3. Maintain and expand efforts to inform potentially eligible Montanans of weatherization program benefits by January 1, 1978.

Current Status

Nearly 2,500 homes have been weatherized to date. Thirty to forty persons are employed full-time across Montana doing weatherization work, supported by a combination of CSA, CETA and Title XX funds. Sixty percent of the homes done to date have been occupied by persons 65 years old and older. Prospects for increased federal appropriations for weatherization appear to be excellent.

Activities

1. Propose legislation seeking state general fund appropriations to match increased federal funding levels.

2. Establish a subcommittee within CACE to explore and advocate mechanisms for increased mobilization of resources for weatherization.

3. Utilize PSAs made by federal government and if appropriate produce PSAs for Montana audiences through the Energy and Resource Policy Office and the Human Resources Division of the Department of Community Affairs.

4. Through university system, identify and mobilize appropriate technical assistance to establish the system.

Weatherization
Program Measure Cont'd.

Evaluation

1. Passage of general fund appropriation by April 15, 1977.

2. Increased program continuity and mobilization of additional resources -- CETA, FHA housing repair loans, HUD, CDA funds -- at an increased rate.

3. Receipt of an additional 3,000 applications for weatherization assistance by December 1, 1977.

4. Have system operational by October 1, 1977.

Table III-18

MONTANA ENERGY PROGRAM

PROGRAM MEASURE TITLE Weatherization

Goal: Minimizing the impact of rising energy costs on persons with limited and low incomes.

TASKS & MILESTONES	Calendar Year 1977				Calendar Year 1978				1979	1980
1. Develop and introduce legislation expanding weatherization program for low income and elderly.	Begin	Passed								
2. Initiate expanded weatherization program.			Begin	Continue	----------	----------	----------	----------	----------	----------
3. Initiate an evaluation system relating to the weatherization program.			Begin	Complete	Continue	----------	----------	----------	----------	----------
4. Improve program coordination among state agencies.					Begin	Continue	----------	----------	----------	
TOTAL COST				0						

Table III-19
Costs of Implementation

	State	Federal
1977	$150,000	$450,000
1978	$150,000	$450,000
1979	$150,000	$450,000
1980	$150,000	$450,000

Program Measure 7
Conservation Loan Programs

Narrative Statement

Two basic economic factors tend to reduce consumer interest in energy conservation: (1) the costs of correcting inefficient uses of energy generally are greater than original construction or installation costs of appropriate conservation measures; and (2) a discrepancy exists between the average and marginal costs of energy supplied to the consumer on the one hand, and the marginal cost to the energy supplier for providing additional units of energy to meet growing consumer demand on the other hand. This second factor is the most serious impediment to rational allocation of capital for conservation. The formulas for determining retail cost of energy to consumers aggregates the more expensive new conversion plants and fuel reserves with the less expensive existing plants and fuel resources. This averaging of old and new costs underestimates the true economic value of end use energy conservation relative to the economic costs of increasing energy supplies and delivery capacity.

Clearly, a need exists to achieve an equilibrium between the marginal life cycle costs of saving a unit of energy through demand reduction and the marginal life cycle cost of converting and delivering an additional unit of energy through supply expansion. The energy conservation loan program promotes this objective through state government encouragement of life cycle energy investment decisions.

Historically, Montana has been a capital-poor state. Most of the wealth generated by the resource extraction and processing industries has accrued to

out-of-state investors. This primary flow of capital out of Montana severely restricts the ability to finance in-state economic development, particularly that of small businesses with limited credit ratings. With the 1975 enactment of the state tax on coal extraction levied at 30 percent of the mine-mouth market value, an opportunity exists to build in-state capital. This coal tax revenue will produce approximately $66 million in the 1976-77 biennium and is forecasted to approach $100 million for the 1978-79 biennium. These state revenues will continue to escalate as the market value of Montana coal increases and as the extraction rate expands to meet national demands for low sulfur coal.

The people of Montana recognized the fiscal danger of a situation in which large sums of coal tax revenue could be spent unwisely for short-term governmental projects and services which do not contribute to the future strength of the economy. In 1976, the Montana Constitution was amended to create a coal tax trust fund in which 25 percent (rising to 50 percent in 1980) of the coal tax revenue would be earmarked as principal to be invested by the state. This investment insures economic benefits to future generations of Montanans when the coal resources have been exhausted.

The central issue regarding this coal tax trust is the Legislature's determination of how these funds will be invested. Currently, the state manages an investment program of $627 million (surplus treasury funds, public employer pension funds, trust funds for schools and universities, etc.). The state's Board of Investments manages the investment program -- operating under the "prudent man rule" (R.C.M. 70-309(1)). The Board must administer the state's investments as if the public funds were the board members' own personal wealth. The effect

of this management policy is an institutional inability to consider the many indirect economic benefits which accrue to the state government as a result of in-state investment of public capital.

Since the potential positive impacts on Montana's employment, property values, taxable corporate and personal income, and other economic factors cannot be considered in the Board's investment decisions, the only criterion of concern is maximizing the rate of return on the investment instrument itself. While it is recognized that there are certain additional investment rules for managing many of these public funds (i.e., trust and legacy funds, public employee retirement funds) which compel maximum interest rates of return, there is no specific requirement that the newly created Coal Tax Trust Fund be restricted to those same single-focus investment principles.

We recommend that the Coal Tax Trust Fund be created as a separate account of the state's unified investment program to be managed by the Board of Investments according to rules and objectives specifically established for this trust. The primary requirement of this fund would be that investments of coal trust monies be made within Montana. These investments could be in the form of time deposits of trust funds with banks, savings and loan associations, and credit unions throughout Montana which then could be issued as loans to Montana citizens, purchases of local government bonds, and purchases of revenue bonds issued by in-state businesses.

It is further recommended that loans of state coal trust funds on deposit at in-state financial institutions should be prioritized to promote, through lower interest rates, investments which conserve energy in homes, farms, public institutions, businesses and industry. The scope of eligible conservation investmen

should be sufficiently broad to include building improvement measures (such as insulation, thermal windows, more efficient furnaces, electric loan management devices, flow reduction water faucets, etc.), consumer loans (such as purchases of energy efficient automobiles, refrigerators, etc.), and large commercial loans for investments in total energy systems, industrial co-generation of process steam and electricity, waste heat recovery systems, and other energy conserving equipment or processes.

In addition to loans for investments which conserve our non-renewable resources, the Trust Fund also should promote investments in systems which convert renewable energy sources (sunlight, winds, biomass and small-scale hydro-electric generation) into useful energy supplies. Such investments should be made only in those renewable energy technologies demonstrated to be technically feasible and cost-effective on a life cycle cost basis. Montana's current alternative energy grant program should be utilized in substantiating the eligibility parameters for renewable energy investments covered by this coal trust loan program.

Estimated Energy Savings for Calendar Year 1980

It is conservatively estimated that $50 million will be available under this program by the end of calendar year 1980. We then will assume that $20 million of this fund actually is loaned for conservation retrofitting in existing residences and businesses and that an additional $10 million in local government revenue bonds for local government conservation retrofit programs are issued. Thus, we assume that $15 million in residential retrofitting takes place by 1980 along with $15 million in commercial and government retrofitting. For approximately $1,500, an average existing Montana residence can reduce its fuel consumption by

50 percent or 75 million BTUs per year. Thus, $15 million will retrofit over 9,900 residences for an end use energy savings of .75 trillion BTUs. If 80 percent of these savings is in fossil fuel and 20 percent is in electricity, the total energy savings (according to the FEA methodology) will be 1.08 trillion BTUs. In commercial and government retrofit, $15 million is assumed to save 100,000 BTUs per square foot per year for $3 per square foot. Thus, the end use energy savings in the government and commercial sectors in 1980 is .5 trillion BTUs. Again, assuming that 80 percent of the energy savings is fossil fuel and 20 percent is electricity, the total commercial and government 1980 energy savings using FEA methodology would be .73 trillion BTUs.

The total 1980 energy savings from implementing this program measure thus are conservatively calculated to be approximately 1.8 trillion BTUs. This calculation assumes that only 60 percent of the available trust fund money actually is invested in conservation retrofit. Potential savings may be twice our reported figure.

Conservation Loan Programs
Program Measure

Goal

Increasing capital availability for implementation of energy conservation and renewable resource measures.

Objectives

1. Passage of legislation governing investment of Coal Tax Trust Fund to promote the investment of funds within the State of Montana, giving preference to depositories providing low interest conservation loans by April 1, 1977.

2. Provide technical assistance to legislatively authorized study on investment policy governing Coal Tax Trust Fund proceeds by July 1, 1978.

3. Organize and conduct a seminar on the benefits of investment in energy conservation and renewable resource measures for financial community by November 1, 1977.

Current Status

Although the Montana Legislature passed a permissive loan program for customers of public utilities during its 1975 session, only one utility has taken the opportunity to make loans for conservation available to its customers. Because investment of higher levels of capital in energy conservation will not only create jobs but will contribute to reduced energy costs in the future, there is a need to make more capital available for energy conservation and renewable resource technology measures.

Activities

1. Draft legislation providing preference for deposits of Coal Tax Trust Fund proceeds with institutions offering low interest conservation loans.

2. Prepare studies on the benefits of increased capital availability for energy conservation on general economic well-being of Montana.

3. Develop a four-hour presentation for financial community on energy conservation technology and impact of energy waste and energy conservation on community economics.

4. Monitor past and present fuel bills of loan participants.

Conservation Loan Programs
Program Measure Cont'd.

Evaluation

1. Adoption of legislation.

2. Publication of studies by April, 1978.

3. Attendance at seminar by cross section of financial community and commitment from participants to consider increased emphasis on energy conservation loans.

4. Actual decrease in consumption will be evaluated based on those participatin in the loan program on a sample basis.

MONTANA ENERGY PROGRAM

Goal: Increasing capital availability for implementation of energy conservation and renewable resource measures.

TASKS & MILESTONES	Calendar Year 1977				Calendar Year 1978				1979	1980
1. Develop and introduce legislation relating to energy conservation loans and tax incentives.										
A. Coal Tax.	Begin	Failed								
B. Tax Incentives.	Begin	Passed								
2. Provide technical assistance relating to conservation loans.			Begin	Complete	Continue					
3. Develop a proposal for an expansion of state housing program to include energy conservation loans.						Begin		Complete		
4. Develop workshops for financial institutions relating to energy conservation loans.					Begin		Complete			
5. Develop an evaluation system to determine actual savings on a sample basis.									Begin	Continue
TOTAL COST				0						

Table III-21
Costs of Implementation

1977	$50,000
1978	$50,000
1979	$55,000
1980	$55,000

The estimated costs of implementation reported here are strictly administrative costs. In addition, the state will lose income due to the preferentially low interest rates that it accepts on in-state investments. This could amount to $150,000 for the year 1980 alone. The state also would receive additional income from the multiplier effect of investing its funds within the state. This additional income cannot be quantified at this time.

Program Measure 8
Renewable Energy Tax Credit

Narrative Statement

In recent years, public interest in renewable energy conversion systems has risen dramatically from an attitude of curious amusement to a growing consensus that solar and wind energies will be major energy sources in the future. While belatedly gaining recognition as the long-term solution to our crisis of non-renewable energy dependency, solar energies have not been widely perceived yet as near-term energy supply options. This reluctance to accept one of the next century's primary energy supplies as the decade's reasonable energy option stems from many factors.

The rapid escalation of fossil fuel prices has been in effect for only the last few years, and there remains much confusion over whether these inflationary pressures will persist indefinitely. This same short period of fossil fuel supply constraints and price rises also marks the beginning of serious consideration of renewable energy alternatives. Hence, a widespread unfamiliarity with the technology of their conversion and use exists. There is also the economic condition of the average cost of conventional energy supplies to the consumer being substantially less than the marginal cost to the supplier for providing new units of depletable energy. This dilution of the new cost of energy among the lower priced, on-line supplies delays the impact on the consumer; and it also reduces the apparent cost effectiveness of renewable energy systems which displace the need for depletable energy consumption. Of no small significance is the

immature status of this fledgling industry. Cost reductions through larger scales of production and innovative materials and designs have not yet reached the marketplace. And, finally, our tax system biases the flow of capital by offering investment tax credits, amortized depreciation, depletion allowances, etc., for large-scale corporate efforts to extract, convert and deliver more non-renewable energy, while individual or family investments in durable, value-producing goods (such as a solar water heater or wind generator) are ignored as frivolous consumer purchases.

To compensate for these conditions which adversely influence the market for renewable energy systems, we recommend that Montana enact a six-year tax credit for investments in purchasing or constructing and installing such systems. This credit would be against a taxpayer's state income tax liability and would be offered on two different schedules. For installations on a principal dwelling unit, a credit of 40 percent of the first $1,000 cost and 20 percent of the next $3,000 cost of the system is available. For installations on real property used in business or trade, the credit would be 40 percent of the first $3,000 and 20 percent of the next $9,000 cost of the system. If the federal government were to enact similar tax credits, the state credit would be reduced, but not eliminated, in order to complement the federal incentive. Renewable energy systems purchased and installed after the six-year period would not be eligible for the state's tax credit because we believe the market stimulating purpose of the incentive will have been accomplished.

We further recommend that for this same six-year period, a taxpayer who installs a renewable energy system may choose to amortize the full value of

that system over a 60-month period. Such amortization would be allowed as a deduction from that taxpayer's adjusted gross income computed for state income tax purposes.

Estimated Energy Savings for Calendar Year 1980

The tax credit will encourage solar hot water heaters. For the purpose of this analysis, we will assume that the average Montana home hot water heater requires 28.7×10^6 BTUs per year. Solar hot water heaters can provide up to 80 percent of the average Montana domestic hot water heating needs at a reasonable cost of about $1,000 per heater. This cost is reduced to $600 per heater by the tax credit. The life cycle cost of the solar energy used is decreased from $2.95 per million BTUs to $1.77 per million BTUs (about the cost of natural gas now). If we assume a 1 percent per year remodeling rate, 6,400 Montana homes in 1980 will have solar water heaters. This would represent a savings in fossil fuels and electricity of .249 trillion BTUs in 1980 (70 percent fossil fuels, 30 percent electricity plus electricity conversion factor).

It is very likely that many other renewable energy systems will be purchased under this program; however, it is impossible to project exactly what they might be or what energy savings might occur.

Renewable Energy Tax Credit
Program Measure

Goal

Increase market for renewable resource technologies by providing increased incentives for investment in renewable resource technology through the tax system.

Objectives

1. Passage of legislation providing substantial tax credits to persons installing renewable energy systems by April 1, 1977.

2. Develop and distribute public information materials describing the tax benefits available through state and federal codes for installation of energy conservation and renewable resource technology measures by July 1, 1977.

Current Status

Montana currently provides Class 8 property tax status to investment in renewable resource technology. This incentive has not proven to be strong enough to stimulate significant investment in these types of technologies. Several states -- Kansas, New Mexico, New Jersey -- have adopted tax credit incentive programs that promise to be more attractive to persons with adequate capital to purchase these technologies. The United States Congress considered such tax incentives last year and many observers believe they will adopt them during the current session.

Activities

1. Draft legislation providing tax credits for investments in renewable resource technologies.

2. Following adoption of legislation, prepare an insert to the Montana Renewable Resource Technology Handbook on the benefits.

3. Distribute the insert to banks, accountants, credit unions and savings and loan associations.

Evaluation

1. Enactment/implementation of legislation by July 1, 1977.

2. Production of one PSA, one pamphlet, and a series of feature length articles by September 1, 1977.

Table III-22

MONTANA ENERGY PROGRAM

PROGRAM MEASURE TITLE

Goal: Increase market for renewable resource technologies by providing increased incentives for investment in renewable resource technology through the tax system.

TASKS & MILESTONES	Calendar Year 1977				Calendar Year 1978				1979	1980
1. Develop and introduce legislation relating to tax credit for renewable energy.	Begin	Passed								
2. Develop state program guidelines.			Begin	Complete						
3. Prepare insert for the Montana Renewable Resource Handbook.					Begin	Complete				
4. Distribute inserts.							Complete			
TOTAL COST				0						

Table III-23
Costs of Implementation

1977	Administrative costs will be assumed by the Revenue Department.	
1978	$800,000	Tax Credit
1979	$800,000	Tax Credit
1980	$800,000	Tax Credit

Program Measure 9
Public Utility Measures

Narrative Statement

Utility Rate Structure Study:

With the exception of fuel used in transportation, the vast majority of energy consumed in Montana is marketed through the fixed utilities which distribute natural gas and electricity. The signals which stimulate consumer decisions on the use of these energy forms are the prices which depend on the rate structure that is approved by the Public Service Commission. It is imperative that the impact of rate schedules on electricity and gas demand be analyzed thoroughly to identify whether the efficient use of energy is encouraged through the regulatory policies of the Commission.

Consumer demand for energy primarily is a function of price; but the effect of price on demand varies with the degree to which a particular demand exceeds those basic energy requirements that must be satisfied irrespective of costs. This variable effect of price on levels of consumption is referred to as the elasticity of demand. Energy needs for physical comfort, hot water, cooking and power for refrigation and lights are less susceptible to reduction because of price than energy needs would be for additional space heating, illumination, convenience appliances, and other energy consuming goods and services which exceed that irreducible level of minimum energy requirements. The reduction of energy consumption is most likely to occur in those marginal end use categories, particularly if state policy intends to maintain equitable minimum energy supplies for all citizens.

Current utility rates for natural gas and electricity are charged on a declining block schedule in which the per unit price decreases as the level of consumption increases. Historically, as the demands on utilities grew, the costs of supplying electricity or natural gas decreased with larger-scale production and distribution facilities. This trend has been reversed in recent years, and it is clear that increased energy supplies will cost substantially more at the margin than the costs of on-line supplies. In Montana, this escalation of new energy supply prices is particularly apparent since the predominant role of hydro-electric generation is being superseded by coal-fired generation capacity; and new natural gas prices continue their steep rise above cost levels that were in effect only two years ago.

With the costs of supplying consumer demands for natural gas and electricity escalating, the appropriateness of declining block rates which promote additional consumption must be evaluated as to its implications for conserving energy and equitably allocating costs among customers according to the utility costs of serving their particular needs. The Montana Consumer Counsel recently granted funds to assist the Montana Power Company in conducting a load characteristic study of randomly selected residential, commercial and industrial customers. By monitoring these customers' demands for electricity as a function of time, the utility company will be able to identify the contributions each customer class makes to the system's energy supply and demand capacity requirements.

It is recommended that this study be augmented with a simultaneous one-year analysis of the operations of the Montana Power Company (and other major utilities if funds permit) to determine the utility's real costs of providing

electric power to all customer classes. Without an accurate assessment of capital and operational costs of providing electric power, the validity of the current rate structure in relation to customer load characteristics cannot be determined fully.

The significant issue of integrating renewable energy conversion systems (solar heating equipment or wind electric generators) with utility networks also should be addressed by this customer load study. There are a limited but growing number of buildings in Montana that are solar heated. We recommend that a select number of these buildings be incorporated into the load study to identify the characteristics of their auxiliary energy demands and to determine how their heat storage capabilities can be used for electric load management purposes.

After one full year's analysis of utility costs of service and customer class load characteristics, the Consumer Counsel and the Public Service Commission should determine whether the existing rate schedules accurately charge just and reasonable rates to customers according to their responsibility for electric service costs incurred for their benefit. This assessment also should consider the long-run marginal cost of service for continued expansion of the utility system. With the completion of this review, the Public Service Commission should recommend an electric utility rate schedule which may reflect more accurately the true costs of service and which will support the conservation of depletable energy resources.

Encouraging Industrial Co-generation of Process Heat and Electricity:

Many of Montana's energy intensive industries consume huge quantities of natural gas for producing process heat and steam necessary for their operations. There are promising opportunities for process steam to be applied to generate electric power in addition to supplying heat and mechanical power. A National Science Foundation study estimates that current industrial co-generation represents only 5 percent of the total capability for implementing this dual purpose energy use in the United States. That same study estimated that the Hoerner-Waldorf paper mill in Missoula has a capability to generate 35 megawatts of electricity in conjunction with its ongoing operations; and the oil refinery complex in Billings represents another major prospect for co-generated electricity.

Since the mechanical and thermal energy of the steam used for industrial generation of electricity is applied subsequently to other industrial processes, the total end use efficiency of the raw source energy is substantially higher than those conversion efficiencies characteristic of central electric generating stations. By implementing conversion technologies which increase end use efficiencies, industrial co-generation can accomplish multiple purposes with a given amount of fuel, thus avoiding the need for redundant and thermodynamically less efficient electric generation capacity in the utility system.

With thorough auditing of each industry's energy consumption and specific energy requirements, the technical feasibility of co-generation can be determined for specific facilities or processes. The existing utility rate schedules for industrial users provides electric power at costs far below the average cost to residential and commercial users and even farther below the marginal costs of

new electric power capacity. As utility rates are evaluated and possibly revised, the economic feasibility of industrial co-generation also may be enhanced as the most cost effective investments in power supply are identified.

We recommend that the Public Service Commission analyze the potential for industrial co-generation as determined from the detailed energy audits to be submitted in compliance with the state's emergency energy allocation plan. The Commission also should assess whether the Electric Supplier's Territorial Integrity Act of 1971 (R.C.M. 70-501) prohibits industrial or commercial co-generation of electric power. This law provides that ". . . an electric utility shall have the right to furnish electric service to any industrial or commercial premises if the estimated connected load for full plant operation at such . . . premises will be 400 kilowatts or larger within two years from the date of initial service . . ." (R.C.M. 70-503(3)).

A final issue deserving the Commission's attention is whether existing electric utilities should be required to enter into purchased power contracts with those industries whose co-generation capabilities exceed their own private electric requirements. In those cases where the co-generated electricity is reliably available at a cost less than what the utility company could provide from its own facilities, the utility should show cause why it would refuse a co-generated electric sales offer. In lieu of this requirement, the designation of common carrier status for fixed energy utilities should be reviewed for its impact on improving the marketability of electric power generated by industry within Montana.

Energy Audits of Large Commercial and Industrial Utility Customers:

On May 30, 1975, the Montana Public Service Commission exercised its emergency rule-making authority by ordering natural gas utilities to prepare (in conjunction with major industrial and commercial gas users) energy conservation plans for improving the efficiency of energy usage by those large customers. If a utility customer did not file an emergency conservation plan by a specific date or if their plan was deemed insufficient by the Commission, the Commission then could impose a monthly penalty curtailment of natural gas up to 10 percent of the amount used by the offending customer during the same month of the previous year. A hearing was held on this emergency rule in September of 1975, adopted by the Commission in December of 1975, to be effective on January 3, 1976.

The need for an accurate audit of how natural gas and electricity are used by large industrial and commercial customers is more pronounced in 1977 than it was in 1975. Significant curtailments of industrial interruptible gas supplies are forecasted for the immediate future, and there are indications that the Bonneville Power Administration may begin to reduce electric power sales to large industrial customers in Northwest Montana. With the severe weather conditions in the Eastern United States and federal considerations of emergency allocation of interstate natural gas supplies, Montana is preparing a comprehensive emergency energy conservation plan which would minimize the economic disruptions of a statewide or national energy emergency.

The Montana Public Service Commission will order all utility companies and their major industrial and commercial customers to conduct an energy audit update and report that information on a standardized form by September 1, 1977. These ener audits will be analyzed by the State and data derived used for determining emergency energy allocation plan activities.

Estimated Energy Savings in Calendar Year 1980

The energy savings expected under some of the individual programs in this program measure are speculative. An energy conservation rate structure that would be effective in calendar year 1980 will save energy as will industrial co-generation of electricity and process steam. Unfortunately, savings cannot be precisely quantified until the actual rate structure is determined and specific co-generation projects are announced. Thus, for the purposes of the Energy Policy and Conservation Act, we claim no specific calendar year 1980 savings for these programs.

In addition, the required industrial and large commercial energy audits will disclose areas in which energy can be saved in a cost effective manner. These expected savings can be quantified. It has been shown on a national basis that the implementation of detailed industrial and large commercial energy auditing programs will result in energy savings in the range of 5 to 10 percent of total energy consumption, with specific examples of savings as high as 20 percent. It is conservatively assumed that this mandatory energy auditing requirement will result in a 7 percent reduction in Montana industrial energy consumption in 1980. If we conservatively project that 1980 industrial energy consumption will remain at the 1975 levels reported by Terry Wheeling in Montana Historical Energy Statistics, the resultant savings will be 6.99 trillion BTUs in 1980.

The auditing requirement also will apply to large commercial customers; however, since many large commercial customers are included in the government sector and will be subject to state government energy auditing programs, we do not report any commercial energy savings here to avoid "double counting" errors.

Since no commercial auditing savings are claimed, commercial energy savings under educational programs in Program Measure 10 will be counted.

Costs of Implementation

Again, implementation costs (see Table III-25) for this program measure are speculative. It likely will require extra personnel to expand the Consumer Counsel study. Placing major additional requirements on the Public Service Commission also will require additional staff. We project that at least two additional staff people will be required for the Public Service Commission during 1977 and 1978, with an additional two people required for 1979 and 1980.

Public Utility
Program Measure

Goal

Utilize the regulatory mechanisms available through the Public Service Commission and the Department of Natural Resources and Conservation to increase and promote the efficient use and production of energy.

Objectives

1. To conduct energy audits of major industrial and commercial sectors by September, 1977.

2. Through executive order, establish emergency energy conservation contingency plans based upon mandatory audits carried out by large industrial and commercial consumers designed to minimize economic disruptions resulting from curtailments in supply by January 1978.

3. Assist Public Service Commission and the Department of Natural Resources and Conservation to obtain funding to carry out a feasibility study on the potential of utilizing excess process steam to produce electricity by February 15, 1978.

Current Status

Like many other states in the West, Montana does not have rate structures that encourage conservation through the pricing of energy. Recently, the Public Service Commission has taken steps to flatten rate structures, but these efforts have been challenged in the courts. The prospect of reduced hydroelectric generating capacity following the below normal precipitation levels underscores the need for rate structures that promote conservation and in the interim calls for the development of contingency plans that will minimize economic disruptions.

Activities

1. Identify interruptible customers and forecast the probability of drought caused disruptions for each customer identified.

2. Prepare procedures for mandatory audits and targets for reductions through increased management.

3. Prepare emergency contingency plans based upon energy audits of industrial and commercial sectors.

Public Utility
Program Measure Cont'd.

4. Inventory ERDA, FEA and Department of Commerce for potential funding for co-generation studies and implementation.

Evaluation

1. Energy audit of large industrial and commercial users will have been conduct by September 1, 1977.

2. Emergency contingency plans will have been developed by February 1, 1978.

Table III-24

MONTANA ENERGY PROGRAM

PROGRAM MEASURE TITLE

Goal: Utilize the regulatory mechanisms available through the Public Service Commission and the Dept. of Natural Resources and Conservation to increase and promote the efficient use and production of energy.

TASKS & MILESTONES	Calendar Year 1977				Calendar Year 1978				1979	1980
1. Develop a mandated energy audit concept in the industrial and large commercial sector.		Begin		Complete						
2. Initiate mandatory energy audit program.										
A. Analysis			Begin		Complete					
B. Monitoring					Begin	Continue				
3. Develop emergency energy conservation contingency plans.			Begin			Complete				
4. Initiate emergency energy conservation contingency plans as necessary.			Potential Begin		Continue					
5. Provice technical assistance to seek co-generation study.				Begin		Complete				
6. Conduct co-generation study.							Begin		Complete	
7. Develop and introduce legislation regarding co-generation.										Complete
TOTAL COST				$35,000						

Table III-25
Costs of Implementation

1977	$50,000 (Estimated	Expanded Consumer Counsel Study
	$50,000	Public Service Commission Staff
1978	$50,000	Public Service Commission Staff
1979	$100,000	Public Service Commission Staff
1980	$100,000	Public Service Commission Staff

Program Measure 10
Energy Conservation Education

Narrative Statement

Commitment to a coordinated program of public education in energy conservation may prove to be the most effective method of saving energy, especially in the long run. Thus, education is central to our plan. The following reasons are offered for placing high priority on educational measures:

1. Since self-interest is a powerful individual motive, education can promote awareness of energy savings choices which are free from negative impacts.

2. Voluntary compliance is the most acceptable form of behavioral modification in a democracy, and bureaucratic costs are minimized in an education program.

3. Energy conservation is a positive and popular ethic (shared by many social groupings in Montana) which can be expressed in a comprehensive education program; existing programs and resources can be integrated to achieve maximum effects.

4. Proven energy saving methods exist for every energy consuming sector of our society simply waiting to be communicated to people; there also is likely to be significant spillover or demonstration effects from sector to sector.

The greatest value will result from an educational program which involves and orchestrates the activities within all major mediums of communication including schools, vocational and adult education, university system outreach, distribution of pamphlets and other materials, print and broadcast channels, demonstration projects, community display programs. This program measure has three components which address the need:

1. Confirmation and expansion of existing programs centered in one or more of these mediums.

2. Promotion and support of new and innovative programs for mediums previously lacking attention.

3. Provision of a state organizational framework for the continuing coordination of public and private education efforts in all mediums.

The key element in the Education Program Measure is the creation of the coordinating mechanism. The state's Energy and Resource Policy Office (ERPO), proposed in the 1977 legislative session, is intended to provide the focal point for integrating energy conservation education and the conduit for channeling future funds for energy conservation research studies. The advisory council of ERPO, composed of representatives of major state agencies which implement other conservation program measures, is intended to provide visible state leadership through both the example of energy conservation in state operations and the aggressive support of education efforts in other medium support. Thus, the advisory councils may be charged with the following tasks:

1. Reviewing expenditures within programs of the university system, the public education system and the Cooperative Extension Service.

2. Monitoring all other programs developed by private groups.

3. Providing comment and review of education programs instituted for state and local government agency personnel.

4. Evaluating possible duplication in state efforts, such as programs of alternative energy development, energy conservation research, and energy conservation education.

The role of ERPO in these functions will be coordinated with the existing Citizen's Advisory Committee on Energy (CACE). The membership of this committee is appointed by the Governor and represents a broad spectrum of interests within the state. The task for CACE is to increase citizen participation in the process of developing the state's energy policies. Subcommittees have been formed to deal

with energy conservation, alternative energy and technology, legal issues, and natural gas reserves. This same framework could be applied to address future energy issues within ERPO. The Citizen's Advisory Committee on Energy has a $56,000 budget request before the Legislature to continue its activities.

While significant efforts must be made in the direction of creating innovative programs, it is equally important to sustain and coordinate a wide variety of existing private and public programs addressing many facets of the energy conservation problem. The Energy and Resource Policy Office can provide strong leadership in the cultivation of a shared public conservation consciousness by promoting and assisting the efforts of programs such as the following:

1. Human Resources Development Councils in 11 areas of the state: The councils provide practical energy conservation and renewable energy information and administer the statewide weatherization program.

2. Montana University System: The universities and colleges of the state provide a tremendous reservoir of talent and information on energy systems, energy conservation and renewable energy. Funding proposals are before the state Legislature this session.

3. Citizen groups: Various citizen groups such as the League of Women Voters, American Association of University Women, the Alternative Energy Resources Organization (AERO), the Environmental Information Center, and numerous others, are sources of information on energy conservation. The activities of these groups should be encouraged since they provide "grass roots" contact with the citizens of the state.

4. Utility company advertising: The various utility companies in the state currently are advertising the benefits of energy conservation. The continuation and expansion of this program will account for measurable energy savings.

5. Adult education programs: For example, the Institute of the Rockies, an educational group in Missoula, currently is planning a statewide seminar program which will focus on energy, technology and life styles.

It is also expected that the Energy and Resource Policy Office will provide long-range leadership in the stimulation of new ideas in energy conservation. In addition to dispensing available monies for research in this area, the office itself should be the source of new ideas and assume responsibility for their formulation into policy initiatives.

Estimated Energy Savings for Calendar Year 1980

It is extremely difficult to establish precise figures for the amount of energy savings expected from comprehensive education efforts. The reasons are evident:

1. The truly significant amounts of saving are expected to show beyond the immediate short run when the effects of adoption of a conservation ethic are apparent.

2. The full spectrum of conservation education activities is not known, nor is it certain which activities can be attributed solely to the program set in motion by the state in response to EPCA.

3. Much of the energy savings attributable to education efforts must be measured indirectly, e.g., in the case of a program which stimulates participation in an incentive program such as solar loans or tax incentives (whose savings are measured directly).

For the purpose of illustrating the multitude of possible energy conserving targets, a sector breakdown including programs, principal mediums of communication and expected range of savings follows.

Table III-26
Examples of Energy Conservation Education Programs

Programs by Sector	Medium	Expected Savings
Residential		
Insulation and Temperature Modulation.	Schools, Pamphlets, Prints & Broadcasts	Immediate
Publicity on Tax Incentive, Loan & Weatherization Programs	Schools, Pamphlets, Prints & Broadcasts	Immediate
Publicity on Alternative Energy Generation	Demonstration Projects, Community Display	Intermediate
Commercial		
Same as Residential		
Competitive Energy Savings Demonstration Projects	Demonstration Projects	Intermediate
Life Cycle Costing	Pamphlets, Demonstration Projects	Intermediate
Industrial		
Energy Auditing	Pamphlets, Workshops	Intermediate
Systems Energy Management	Pamphlets, Workshops, Training	Immediate
Co-generation	Pamphlets, Workshops	Long-Range
Transportation		
Driver Training, Operation, Maintenance	Schools, Vocational Co-op Extension	Immediate
Energy Efficient Auto Purchases	Multiple, Pamphlets	Immediate
Car Pooling Promotion	Multiple, Demonstration Projects	Immediate

Table III-26 Cont'd.

Programs by Sector	Medium	Expected Savings
Alternative Transport, Bicycles, Pedestrian	Multiple, Pamphlets	Immediate
Mass Transit	Multiple, Demonstration Projects	Intermediate
Agriculture		
Cropping and Fallowing	Co-op Extension, Pamphlets, Demonstration	Immediate
Natural Fertilizing	Co-op Extension, Pamphlets, Demonstration	Immediate
Biomass Conversion	Co-op Extension, Pamphlets, Demonstration	Intermediate
Wind Power	Co-op Extension, Pamphlets, Demonstration	Intermediate
Government		
Agency Training	Workshops, Pamphlets, Demonstration Projects	Immediate
Intergovernmental Transfers	Workshops, Pamphlets, Demonstration Projects	Immediate
Private Activity Transfers	Demonstration Projects, Pamphlets, Prints & Broadcast Media	Intermediate
"Model" Renewable Energy Demonstration Projects	Demonstration Project	Intermediate to Long-Range

Notwithstanding the problems of calculating actual energy savings, the total potential can be estimated. Estimates are based on methodologies used by Skidmore, Owings and Merrill (SOM) of Portland, Oregon, for the Bonneville Power Administration to establish the effectiveness of energy conservation education programs used or proposed by both public utilities and state agencies. SOM projected that a coordinated educational program implemented by states and utilities could save 3 percent of the overall projected 1980 electric consumption in the Pacific Northwest. The proposed Montana program is even more extensive than those studied. According to SOM, the largest savings appeared possible in the commercial sector (5.8 percent), while the smallest savings took place in the industrial sector (2.5 percent). Residential savings amounted to 2.75 percent. While the SOM study focused only on electricity, Montana's educational program will focus on all energy consumption sectors and energy forms.

Based on SOM figures, we estimate conservatively that our program will reduce projected 1980 electrical consumption by 2 percent in the residential sector and 4 percent in the commercial sector. Industrial energy savings have previously been claimed under Program Measure 9 and thus no additional savings will be counted here. Since data on projected 1980 energy consumption by sector is unavailable, a conservative estimate places the growth of electrical energy consumption in the residential and commercial sectors at 3 percent annually. Thus, overall savings will equal 172.2 million kilowatt hours or 1.31 trillion BTUs (11,300 BTUs per kilowatt hour) in 1980.

In natural gas use, a conservative estimate sets 1980 consumption at the same level as that in 1975. Assuming a 3 percent reduction in residential and commercial sectors caused by educational programs, a total savings of 1.32 trillion BTUs for 1980 can be calculated. Using the same assumptions, a savings

Table III-26 Cont'd.

Programs by Sector	Medium	Expected Savings
Alternative Transport, Bicycles, Pedestrian	Multiple, Pamphlets	Immediate
Mass Transit	Multiple, Demonstration Projects	Intermediate
Agriculture		
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Natural Fertilizing	Co-op Extension, Pamphlets, Demonstration	Immediate
Biomass Conversion	Co-op Extension, Pamphlets, Demonstration	Intermediate
Wind Power	Co-op Extension, Pamphlets, Demonstration	Intermediate
Government		
Agency Training	Workshops, Pamphlets, Demonstration Projects	Immediate
Intergovernmental Transfers	Workshops, Pamphlets, Demonstration Projects	Immediate
Private Activity Transfers	Demonstration Projects, Pamphlets, Prints & Broadcast Media	Intermediate
"Model" Renewable Energy Demonstration Projects	Demonstration Project	Intermediate to Long-Range

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In natural gas use, a conservative estimate sets 1980 consumption at the same level as that in 1975. Assuming a 3 percent reduction in residential and commercial sectors caused by educational programs, a total savings of 1.32 trillion BTUs for 1980 can be calculated. Using the same assumptions, a savings

of .48 trillion BTUs of propane and fuel oil is counted. (Estimates in this sector are based on simple behavioral changes. For example, a program encouraging thermostat control -- 68 degrees F night as opposed to a constant 70 degree F setting -- can save nearly 15 percent of gas consumption in a typical residence.)

Finally, educational programs addressing transportation will influence people to buy smaller cars, radial tires, and other fuel savings options. Educational programs to promote proper driving and maintenance habits will also save energy. It is assumed that programs such as these can influence 15 percent of the motor vehicle users in Montana to procure and operate motor vehicles in a manner that would reduce their vehicular energy consumption by 10 percent, producing a 1.5 percent overall decrease in transportation energy consumption in 1980. This reduction amounts to 1.18 trillion BTUs under the assumption that transporation energy consumption will grow by 3 percent annually.

The total energy savings for 1980 from these educational programs is projected at 4.29 trillion BTUs, a figure likely to be lower than the actual savings. The source of data used in these calculations is Montana Historical Energy Statistics (Terry Wheeling, Montana Energy Advisory Council, September 1976). All consumptions used are stated explicitly therein. It should be emphasized that these projected savings are separate from those calculated for the other program measures. The savings associated with educational programs leading to participation in measures such as the conservation loan program or the renewable energy tax credit have been counted as part of the direct savings within those programs.

Costs of Implementation

As in the case of estimated energy savings, the costs of the programs in energy conservation education are difficult to calculate because of the close interface between public and private efforts and the problem of demarcating direct and indirect costs. The true value of the overall conservation program undoubtedly is underestimated by the assignable costs since the program benefits from the momentum of existing programs, from the presence of administrative structures in place to administer new programs, and from the existence of substantial materials available for distribution. For these reasons, the program can be considered highly cost effective, even considering the largely unknown probability of public response.

Energy Conservation Education
Program Measure

Goal

Promote change in cultural values toward energy use through a public education program.

Objectives

1. Passage of legislation establishing an Energy and Resource Policy Office and providing funding for a Citizen's Advisory Committee on Energy by April 15, 1977.

2. Establish an ongoing planning/implementation process involving local, state, private and public organizations and agencies with capabilities in and commitment to energy conservation education by June 1, 1977.

3. Inaugurate an energy conservation media development and information resource service unit to supply the needs of the various agencies and organizations engaged in energy conservation education efforts by September 30, 1977.

Current Status

Montana's concern over unbridled industrialization of rural areas based on the growing demand for coal provides a receptive audience for responsible energy use. Many organizations that have expressed an interest in carrying the message about the need for more efficient energy use have been hampered by inadequate or non-existent educational materials.

Activities

1. Draft legislation calling for the creation of an Energy and Resource Policy Office.

2. Inventory various interest groups and solicit representation and commitment to energy conservation planning.

3. Inventory capabilities and resources for production of media and informational materials.

Energy Conservation Education
Program Measure Cont'd.

Evaluation

1. Enactment/implementation of legislative provisions by January 1, 1978.

2. Initiation of expanded energy conservation education programs by 20 agencies and/or organizations.

3. Production of multi-media presentations and maintenance of specialized library of resource materials in response to requests from agencies and organizations.

Table III-27

MONTANA ENERGY PROGRAM

PROGRAM MEASURE TITLE: Energy Conservation Education

Goal: Promote change in cultural values toward energy use through a public education program.

TASKS & MILESTONES	Calendar Year 1977				Calendar Year 1978				1979	1980
1. Develop and introduce legislation regarding focal point of energy management (see supplemental plan-intergovernmental program measure)	Begin	Passed								
2. Develop an inventory of all current public education efforts in energy conservation.			Begin	Complete						
3. Develop a public education program relating to the program measures 1-9.			Begin	Implement	Continue	----------	----------	----------	----------	----------
4. Evaluate specific aspects of public education program measure (pre- and post- public surveys).					Begin		Complete			
5. Revise and update public education program measure as required.						Begin	Complete	Continue	----------	----------
TOTAL COST				$20,379						

Table III-28
Costs of Implementation

1977	$144,000	Energy and Resource Policy Office
	$ 60,000	Energy Extension Service
1978	$144,000	Energy and Resource Policy Office
	$ 28,000	Energy Extension Service
1979	$160,000	Energy and Resource Policy Office
	$ 70,000	Energy Extension Service
1980	$160,000	Energy and Resource Policy Office
	$ 70,000	Energy Extension Service

Table III-29
Summary of Program Measure Responsibility in State Agencies

1.	State Building Code	Department of Administration Department of Health and Environmental Sciences Department of Community Affairs
2.	Public Building Lighting Standards	Department of Administration Department of Community Affairs
3.	Procurement; Life Cycle Cost Analysis and Vehicle Efficiency Standards	Department of Administration Department of Community Affairs
3a.	Energy Managing, Auditing, and Retrofitting State Buildings	Department of Administration
3b.	Renewable Energy Demonstration Project	Department of Administration Department of Natural Resources and Conservation
4.	Right Turn on Red	----------
5.	Car Pool/Van Pool: Increase in Transit Level of Service	Department of Community Affairs

Table III-29 Cont'd.

5a.	Public Transportation and Railroad Assistance Fund	Department of Community Affairs
5c.	Enforcement of 55 M.P.H. Speed Limit	Department of Justice
6.	Weatherization	Department of Community Affairs Department of Social & Rehabilitation Services
7.	Conservation Loan Programs	Department of Revenue
8.	Renewable Energy Tax Credit	Department of Revenue
9.	Public Utility Measures	Public Service Commission
10.	Energy Conservation Education	Energy and Resource Policy Office

Program Measures 3, 5a, 5b, 5c, 10
Program Note: Crude Oil Savings

Based on recommendations in the "Final Assessment of the Environmental Impacts of the State Energy Conservation Program" (Page 22), the projected savings in evaporative losses in refineries and additional savings in crude oil can be determined. The total gasoline equivalent from the preceding transportation measures is 41,719,144 gallons of gasoline per year. Assuming an efficiency of 91 percent at the oil refining process, the corresponding savings in refinery losses is 3,755,123 gallons of gasoline per year or .47 trillion BTUs per year.

Administrative Analysis

A charge often leveled against federal government grant-in-aid programs is that they tend to distort a state's own priorities in the allocation of resources to public policies. Sometimes, the costs to a state in terms of required state legislation, administrative regulations, and/or matching funding requirements outweigh the benefits of the federal assistance. The growth of bureaucratic structure, the expansion of the network of intergovernmental relations, and heightened conflict among officials at national, state and local levels all have been found to follow the acceptance of federal monies intended to meet a variety of social goals. Each state must carefully weigh for itself the net effect of participation in federal government induced programs requiring state compliance procedures.

This evaluation has been applied to the requirements of the Energy Policy and Conservation Act. The state has concluded that there are substantial net benefits by complying with EPCA. In the first place, Montanans fully embrace the principle of energy conservation and welcome the commitment of all levels of government in the United States to an aggressive, but cooperative, program of husbanding the nation's scarce energy reserves. In fact, Montana's leaders have expressed their intention to be the nation's leaders in this vital area, proceeding well beyond EPCA's minimum standards in pursuit of significant long-range energy savings through the development of renewable energy. Thus, Montana's priorities are the same as those of all of America in this crucial program, and the EPCA goals complement the state's mission.

The heavy emphasis being placed on the voluntary dimensions of energy conservation in Montana, through vehicles such as economic incentive and education programs, allows for minimizing the problems and frictions inherent in changing bureaucratic structures and patterns of intergovernmental relations. Even prior to the EPCA solicitation, the state began seriously considering internal reorganization of several agencies and departments charged with various energy and resource functions. The EPCA stimulus, therefore, has proven to be a catalyzing agent for many activities already set in motion. For this reason, the FEA role in energy conservation is accepted enthusiastically with the expectation that federal funds can assist greatly in the state's own program.

The introduction of a systematic statewide energy conservation program will create little state-local conflict over implementation strategies. Greater clarification in the state-local division of powers and responsibilities is a

basic principle of a proposed new code of local government which is the culmination of a three-year study of the powers, capacities and resources of local governments. The state has the responsibility to require conformance of local governments in those energy conservation matters which are of concern to all Montana citizens. At the same time, maximum flexibility is allowed local governments in designing innovative and imaginative methods of energy conservation and alternative energy generation.

Impact on Local Governments

Just as the EPCA grant mechanism requires some alterations of state policies, the state government, in turn, must revise certain state-local relationships to produce compliance with the federal mandate at the local level. The implementation of an energy conservation plan involving local governments coincides with the last phase of a three-year program of local government reorganization whose scope is unparalleled anywhere in the nation. The Legislature currently is considering a massive recodification of local government laws which, if adopted, will change dramatically the powers, capabilities, resources and functions of local governments throughout the state. In combination with existing constitutional provisions, earlier laws, and decisions recently reached by the electorates of many local units in the recently completed voter review process, this recoding signals a new era of maximum local self-determination in Montana. The requirements imposed upon local governments by an energy conservation plan must be weighed carefully in the context of these changes.

A well designed energy conservation plan can take advantage of this expanded local self-determination. Maximum opportunity for innovative conservation and alternative energy development projects at the local level is afforded by several changes in the status of local government:

1. The acquisition of legislative powers by counties previously hamstrung by restrictive state laws which had specified narrowly both the subjects of county resolutions and the procedures of fulfilling county duties.

2. The provision of much broadened service options and more flexible service delivery mechanisms within the revised code for both the counties and incorporated municipalities falling under the category of general powers of local governments.

3. The acquisition of self-government powers status by several local government units enabling them to perform any functions not denied specifically to this class of localities by the Legislature.

4. Constitutional stipulation that the powers of local government are to be construed liberally by the courts.

5. Constitutional provision of maximum opportunity for inter-local cooperation in developing joint jurisdictional solutions to solve service delivery problems.

The combination of these measures creates a number of possibilities for experimentation in different communities in a wide variety of creative conservation efforts. Those successful in one setting then can be replicated in other communities

Although the details of the code still are pending possible alterations, it appears that the following examples of local innovation are possible:

1. Counties with urban areas outside of the limits of an incorporated municipality have the authority to approve creation of an energy-related service delivery function.

2. Contiguous local government units can pool resources in the exercise of an energy creation of distribution functions which individual units may be unable to afford.

3. Sixteen local government units can initiate unique community energy projects under self-government powers and can be selected for model projects.

4. Planning and zoning restrictions do not appear to limit the possibility of alternative energy facilities.

5. Provision of community development authortiy appears to allow a community to develop alternative energy facilities as an element of the fight against "blight and environmental decline".

6. Power is available to create subordinate solid waste disposal districts which could utilize innovative local recovery methods.

7. Local traffic right-of-ways seem capable of being employed as a public use for distributing alternative energy.

8. Capital improvement districts can be established under a variety of user fee mechanisms, including criteria such as "relative usefulness" or "connection", which make it possible to create an alternative energy neighborhood where not all residents are required to participate.

These are but a few examples of the widened latitude provided to local governments in the area of alternative energy and conservation efforts. They offer a great opportunity for the state to become a leader in testing the validity of the principle of decentralized energy generation and distribution.

The second major area of consideration is the possible friction between state and local levels of government in implementing mandated programs. Here again, the consequences of the three-year state review of local government functions is pertinent. There currently is much greater acceptance of the principle of dividing primary responsibility for various service functions between state and local levels. Thus, while a certain activity which is primarily a state responsibility may be delegated to local governments, the delegation must be accompanied by the provision of the resources required to carry out the activity. Adherence to this principle is illustrated by the satisfactory manner in which the problem of local building code inspection has been handled.

The EPCA guidelines do not require the State of Montana to violate the new compact of liberation with its local government partners. Certain conservation areas afford an opporunity for strengthening the partnership through collaborative compliance with EPCA mandates. Procurement practices provide the best illustration since the state is authorized to select the methods most appropriate to its circumstances for inducing political subdivisions to adapt their practices to state procedures. In Montana, the choice has been made to work through established channels of state-local communicators in the Department of Community Affairs. Within this channel, cooperation and collaboration have been chosen as the method of achieving objectives. To this end, programs of orientation and training at the state level will be offered for local official participation as well. Regularized communication of new developments in training, procedures or assistance will be made to local officials. State and local officials will participate jointly in planning and implementing future training and review sections. Local governments will be encouraged to participate in state purchasing contracts to maximize energy savings. In each of these respects, the emerging cooperative relationship between state and local governments is reinforced rather than threatened.

In summary, the EPCA mandates indroduce no significant dysfunctional variables into the equation of state-local relationships in Montana. The timing is opportune since energy conservation relationships still can be included in the final package being wrapped in the Legislature and confirmed as an important part of the bargain struck between state and local governments. There are no consequential bureaucratic costs of compliance resulting from EPCA in the state-local area.

Impact on State Agencies

The various implementation strategies add mandates within a number of state agencies. Some changes are of immediate concern and require action of the 1977 Montana legislative session, while others can be handled through executive revision of existing administrative structures. The development of a comprehensive and workable energy conservation organizational structure may require both legislative and administrative attention over several years. As in the policy area, the evolution of the ideal bureaucratic structure will involve a sequential process of innovation and revision. This discussion outlines the organizational steps already taken and places them in the context of long-range administrative goals.

The current legislative session will establish the Montana Energy and Resource Policy Office (ERPO) within the Governor's Office as the successor to the Montana Energy Advisory Council (under whose auspices this EPCA submission has been developed). This action will institutionalize the state's commitment to the careful and continuous scrutinization of all policies associated with energy development and energy conservation. A sharp focus and sustained public visibility is achieved by placing this mandate directly under the Governor. Maximum coordination of all energy-related activities also is produced. Energy conservation and the wise utilization of existing resources thereby is given equal stature with the goal of finding and developing new sources of energy supply.

Under terms of the legislation, energy conservation is given significant standing. ERPO is charged with developing periodic recommendations for energy conservation techniques which will comprise part of a comprehensive state energy policy. These recommendations will culminate in the formulation of a state energy conservation program dealing in further detail with the subjects contained

in this report. Special focus is to be placed upon possible savings in the energy-related activities of state government and upon public education in methods of energy conservation. Comprehensiveness of scope and coordination of conservation activities are enhanced by the stipulation of ERPO advisory council representation by state agencies dealing in key facets of the state's resource program. ERPO also will coordinate the disbursement of funds for energy conservation research and education.

In addition to ERPO's creation, the intensified concern with energy conservation will produce the following changes in agency structures and mandates. The Department of Administration is given significant additional responsibilities, some of which are to be carried out in conjunction with related state agencies. The Department of Administration is charged with producing the life cycle cost analysis for state buildings and procurement of major energy consuming equipment. The Department of Administration also is assigned primary responsibility for creating and implementing the building code provisions for thermal and lighting efficiency, but must work with the Department of Health and Environmental Sciences in developing the code's contents and with the Department of Community Affairs in its implementation by local building code inspectors.

The Department of Community Affairs is given several new or expanded functions as a result of the need to promote conservation at the local level. Expansion of the weatherization program will require continuation of the cooperative effort involving the Department of Social and Rehabilitation Services. No new mandates or unmanageable problems of compliance are imposed by this program. These two agencies already have addressed methods of enhancing efficiency and

promoting increased cooperation in achieving the goal of assisting low income persons in saving energy costs. The Department of Community Affairs also will assume a significant responsibility for disbursing funds within the Public Transit and Railroad Assistance Fund.

Finally, the Department of Community Affairs (DCA) will be expected to develop a major role in communication with local governments on a wide variety of energy conservation methods. DCA will be the link between ERPO and the cities, towns and counties and should play a major role in making available to local officials the latest information on savings in areas such as purchasing, life cycle cost analysis, and training and education regarding building codes. In each of these cases, the added responsibilities will be commensurate with the important role charged to the Department of Community Affairs as the link between the state and local levels in Montana.

The Department of Revenue will have two major new responsibilities: The implementation of tax credit and accelerated amortization of cost systems for promoting installation or acquisition of renewable energy resource equipment and the low interest loan program for installation of energy conserving equipment and devices under the terms of provisions regarding the Coal Tax Trust Fund and the banking system.

Other agencies will be assigned duties consistent with their current primary missions. For example, the Department of Justice in the speed limit enforcement program and the Public Service Commission in the state utility rate structure program. The Department of Natural Resources, current sponsors of the state's grant and loan programs for alternative energy development, likely

will have a continuing involvement in those conservation activities which interface its mandate. The intergovernmental framework will be complicated in the future by the possible development of a source separation solid waste recovery system within the Department of Health and Environmental Sciences and the consolidation of transportation functions within a new Department of Transportation.

Assessment of Energy Savings

The energy savings estimated in this plan are based on projections. Projections are a "best guess" of what will happen in the future based on numerous assumptions. If those assumptions do not match reality, the projections will be wrong. There are many variables that simply cannot be quantified. Thus, in addition to adopting the measures outlined, the state must monitor patterns in energy consumption within Montana very carefully to insure that the various program measures are indeed having the desired effect. The worst mistake that the state could make would be to do nothing.

In recognition of this, the Montana Energy Advisory Council's report to the Governor recommends that a Governor's Energy and Resource Policy Office should be established. The Energy and Resource Policy Office would have numerous responsibilities. Among them are specific responsibilities related to data collection and analysis. This office will be the central collection point for energy information in Montana. The office would prepare long-range projections of the supply and demand for energy in Montana on an annual basis. Specifically, they would

collect the data necessary to measure the effectiveness of the program measures contained in this document.

Legislation to create this Energy and Resource Policy Office has been introduced into the Montana House of Representatives (H.B. 204). The charter of the office would be to recommend energy conservation techniques and other appropriate energy policies to the state. Specifically, this legislation assigns the following duties to the Energy and Resource Policy Office.

1. Serve as the central repository within the state government for the energy- and resource-related research carried on in and for the state.

2. Prepare recommendations for an emergency allocation plan specifying actions to be taken in the event of an impending serious shortage of energy.

3. Undertake a continuing assessment of trends in the consumption of all forms of energy and analyze the social, economic and environmental consequences of those trends.

4. Collect and analyze data relating to present and future demands and resources for all sources of energy and project energy requirements for the state and various service areas within the state.

5. Evaluate policies governing the fixing of rates and prices for energy in terms of their relationship to energy conservation and make recommendations with respect to those policies.

6. Analyze energy-related activities of agencies of state government and make recommendations with respect to those activities.

7. Prepare, on a continuing basis, recommendations for a comprehensive energy policy for the State of Montana and study the impact and relationship of the state energy policies to international, national and regional energy policies.

8. Formulate a state program for energy conservation, including, without limitation, general commercial, industrial and residential areas and the evaluation of energy systems as they relate to lighting, heating, refrigeration, air conditioning, building design and operations, and appliance manufacturing and operation.

9. Inform and educate the public about ways of conserving energy.

10. Develop and prepare on a continuing basis the policy and plans required by R.C.M. 70-827(1)(a).

IV. ENVIRONMENTAL RESIDUALS STATEMENT

The State of Montana has made a commitment to environmental protection. Every citizen's right to a clean and healthful environment is protected constitutionally in Montana.

Environmental residuals specifically were considered in developing this plan from both a state and a national perspective. Environmental residuals were calculated using FEA methodology for each program measure, and no program is included which, in our judgment, has a significant negative environmental impact.

Special consideration was given to programs which would increase the amount of insulation in Montana residences. It is known that certain types of insulating materials present environmental and occupational health and safety hazards both in their manufacture and use. To counteract this potential problem, a bill will be introduced into the 1977 Montana Legislature to prohibit certain uses of specific insulating materials (primarily asbestos) and to develop criteria for safe substitute materials. This legislation was a direct result of our analysis of potential environmental problems related to energy conservation.

In general, we found that a decrease in energy consumption results in positive environmental benefits due to reduced environmental degredation from energy conversion. Also, the aspect of individual participation in energy conservation promotes an increased sense of community and a feeling of participation in an action that is socially important. Thus, participating in a large-scale, coordinated energy conservation program may have, in fact, a synergistic environmental benefit. People conserving energy realize that their actions will have positive environmental consequences and, hence, may open their eyes to other areas where they can act individually in an environmentally beneficial manner.

The FEA environmental residuals summary follows on the next pages.

Table IV-1
Direct Emissions From Automobile Operation
(Environmental Impact per 10^{12} BTU of Gasoline)

Impact	Coefficient for Reduction	Energy Reduction	Resultant Emission Reduction
Water (tons)			
Acids			
Bases			
Dissolved Solids, Mis.			
Suspended Solids			
Non-degradable Org.			
Biological Oxygen Demamd			
Chemical Oxygen Demand			
Air (tons)			
Particulates	62	5.56	344.72
Oxides of Nitrogen	298	5.56	1,656.88
Sulfur Dioxide	15	5.56	83.40
Hydrocarbons	201	5.56	1,117.56
Carbon Monoxide	2,120	5.56	11,787.20
Carbon Dioxide	74,500	5.56	414,220.00
Aldehydes		5.56	
Other			
Thermal Rejection (BTU)			
Occupational Death (Men)			
Occupational Injuries (Men)			
Occupational Man-Day Lost (Man-Day)			
Solid Waste (tons)			

Note: Data courtesy of the Federal Energy Administration.

Table IV-2
Direct Emission From Diesel Bus Operation
(Environmental Impact per 10^{12} BTU of Diesel Oil)

Impact	Coefficient for Reduction	Energy Reduction	Resultant Emission Reduction
Water (tons)			
Acids			
Bases			
Dissolved Solids, Mis.			
Suspended Solids			
Non-degradable Org.			
Biological Oxygen Demand			
Chemical Oxygen Demand			
Air (tons)			
Particulates	45.7	.01	.457
Oxides of Nitrogen	1,296.0	.01	12.960
Sulfur Dioxide	94.8	.01	.948
Hydrocarbons	127.0	.01	1.270
Carbon Monoxide	787.0	.01	7.870
Carbon Dioxide	80,000.0	.01	850.000
Aldehydes	20.7	.01	.207
Other			
Thermal Rejection (BTU)			
Occupational Death (Men)			
Occupational Injuries (Men)			
Occupational Man-Day Lost (Man-Day)			
Solid Waste (tons)			

Note: Data courtesy of the Federal Energy Administration.

Table IV-3
Emissions From Production and Distribution of Vehicle Fuels
(Environmental Impact per 10^{12} BTU of Vehicle Fuels)

Impact	Coefficient for Reduction	Energy Reduction	Resultant Emission Reduction
Water (tons)			
Acids			
Bases			
Dissolved Solids, Mis.	0.40	5.55	2.22
Suspended Solids	0.76	5.55	4.22
Non-degradable Org.	2.41	5.55	13.38
Biological Oxygen Demand	0.76	5.55	4.22
Chemical Oxygen Demand	4.66	5.55	25.86
Air (tons)			
Particulates	3.20	5.55	17.76
Oxides of Nitrogen	26.00	5.55	144.30
Sulfur Dioxide	23.50	5.55	130.43
Hydrocarbons	26.00	5.55	33.30
Carbon Monoxide	3.00	5.55	16.65
Carbon Dioxide		5.55	
Aldehydes	4.15	5.55	23.03
Other			
Thermal Rejection (BTU)			
Occupational Death (Men)	0.0007	5.55	.0039
Occupational Injuries (Men)	.05	5.55	.2775
Occupational Man-Day Lost (Man-Day)	2.50	5.55	13.88
Solid Waste (tons)	48.00	5.55	266.40

Note: Data courtesy of the Federal Energy Administration.

Table IV-4
Space Heat, Commercial, Natural Gas
(Environmental Impact per 10^{12} BTU)

Impact	Coefficient for Reduction	Energy Reduction	Resultant Emission Reduction
Water (tons)			
Acids			
Bases			
Dissolved Solids, Mis.			
Suspended Solids			
Non-degradable Org.	.02	2.289	.046
Biological Oxygen Demand		2.289	
Chemical Oxygen Demand		2.289	
Air (tons)			
Particulates	9.25	2.289	21.20
Oxides of Nitrogen	152.06	2.289	348.10
Sulfur Dioxide	.314	2.289	.719
Hydrocarbons	3.95	2.289	9.04
Carbon Monoxide	9.72	2.289	139,629.00
Aldehydes	4.90	2.289	11.22
Other			
Thermal Rejection (BTU x 10^9)	.89	2.289	2.04
Occupational Death	.0002	2.289	.0005
Occupational Injuries (Men)	.03	2.289	.069
Occupational Man-Day Lost (Man-Day)	92.80	2.289	212.42
Solid Waste (tons)			

Note: Data courtesy of the Federal Energy Administration.

Table IV-5
Space Heat, Commercial, Distillate Oil
(Environmental Impact per 10^{12} BTU)

Impact	Coefficient for Reduction	Energy Reduction	Resultant Emission Reduction
Water (tons)			
Acids			
Bases			
Dissolved Solids, Mis.	.40	.596	.238
Suspended Solids	.76	.596	.453
Non-degradable Org.	2.40	.596	1.430
Biological Oxygen Demand	.76	.596	.453
Chemical Oxygen Demand	4.66	.596	2.780
Air (tons)			
Particulates	57.26	.596	34.130
Oxides of Nitrogen	242.98	.596	144.820
Sulfur Dioxide	137.45	.596	81.920
Hydrocarbons	37.17	.596	22.150
Carbon Monoxide	75.00	.596	44.700
Carbon Dioxide	85,000.00	.596	50,660.000
Aldehydes	11.40	.596	6.790
Other			
Thermal Rejection (BTU)		.596	
Occupational Death (Men)	.0007	.596	.0004
Occupational Injuries	.05	.596	.0298
Occupational Man-Day Lost (Man-Day)	2.50	.596	1.490
Solid Waste Tons	48.00	.596	28.610

Note: Data courtesy of the Federal Energy Administration.

Table IV-6
Space Heat, Commercial, Residual Oil
(Environmental Impact per 10^{12} BTU)

Impact	Coefficient for Reduction	Energy Reduction	Resultant Emission Reduction
Water (tons)			
Acids			
Bases			
Dissolved Solids, Mis.	0.39	.299	.117
Suspended Solids	0.76	.299	.227
Non-degradable Org.	2.41	.299	.721
Biological Oxygen Demand	0.76	.299	.227
Chemical Oxygen Demand	4.66	.299	1.390
Air (tons)			
Particulates	80.06	.299	23.94
Oxides of Nitrogen	226.90	.299	67.84
Sulfur Dioxide	540.50	.299	161.62
Hydrocarbons	36.40	.299	10.88
Carbon Monoxide	3.47	.299	1.038
Carbon Dioxide	85,000.00	.299	25,415.00
Aldehydes	7.5	.299	2.24
Other			
Thermal Rejection (BTU)			
Occupational Death (Men)	.0007		.0002
Occupational Injuries (Men)	.049		.015
Occupational Man-Day Lost (Man-Day)	2.52		.753
Solid Waste (tons)	48.02		14.360

Note: Data courtesy of the Federal Energy Administration.

Table IV-7
Space Heat, Commercial, Coal (26.2×10^6 BTU/Ton) (1% Sulfur)
(Environmental Impact per 10^{12} BTU)

Impact	Coefficient for Reduction	Energy Reduction	Resultant Emission Reduction
Water (tons)			
Acids			
Bases	.99		
Dissolved Solids, Mis.	26.70		
Suspended Solids	5.77		
Non-degradable Org.			
Biological Oxygen Demand			
Chemical Oxygen Demand			
Air (tons)			
Particulates	443.90		
Oxides of Nitrogen	125.80		
Sulfur Dioxide	755.40		
Hydrocarbons	48.34		
Carbon Monoxide	206.10		
Carbon Dioxide	111,000.00		
Aldehydes	1.33		
Other			
Thermal Rejection (BTU)			
Occupational Death (Men)	.07		
Occupational Injuries (Men)	1.22		
Occupational Man-Day Lost (Man-Day)	92.20		
Solid Waste	8,696.00		

Note: Data courtesy of the Federal Energy Administration.

Table IV-8
Space Heat, Residential, Natural Gas
(Environmental Impact per 10^{12} BTU)

Impact	Coefficient for Reduction	Energy Reduction	Resultant Emission Reduction
Water (tons)			
Acids			
Bases			
Dissolved Solids, Mis.			
Suspended Solids			
Non-degradable Org.	.02	3.416	.068
Biological Oxygen Demand			
Chemical Oxygen Demand			
Air (tons)			
Particulates	9.24	3.416	31.60
Oxides of Nitrogen	127.50	3.416	435.50
Sulfur Dioxide	.31	3.416	1.10
Hydrocarbons	3.96	3.416	13.10
Carbon Monoxide	9.68	3.416	33.10
Carbon Dioxide	61,000.00	3.416	208,376.00
Aldehydes	4.86	3.416	16.60
Other			
Thermal Rejection (BTU x 10^9)	.89	3.416	3.00
Occupational Death (Men)	.0002	3.416	.0007
Occupational Injuries (Men)	.03	3.416	.10
Occupational Man-Day Lost (Man-Day)	.90	3.416	3.10
Solid Waste (tons)			

Note: Data courtesy of the Federal Energy Administration.

Table IV-9
Electric Generation, Steam (Coal-Fired)
(Environmental Impact per 10^{12} BTU)

Impact	Coefficient for Reduction	Energy Reduction	Resultant Emission Reduction
Water (tons)			
Acids	12.1	6.99	84.6
Bases	1.0	6.99	7.0
Dissolved Solids, Mis.	62.5	6.99	435.9
Suspended Solids	9.0	6.99	62.9
Non-degradable Org.	1.3	6.99	9.1
Biological Oxygen Demand			
Chemical Oxygen Demand			
Air (tons)			
Particulates	7.35*	6.99	51.4
Oxides of Nitrogen	348.0	6.99	2,432.5
Sulfur Dioxide	160.0*	6.99	1,118.4
Hydrocarbons	8.4	6.99	58.7
Carbon Monoxide	23.1	6.99	161.5
Carbon Dioxide	104,000.0	6.99	726,960.0
Aldehydes	0.68	6.99	4.8
Other			
Thermal Rejection (BTU x 10^9)	249.0	6.99	1,740.5
Occupational Death (Men)	.0759	6.99	.53
Occupational Injuries (Men)	1.32	6.99	9.2
Occupational Man-Day Lost (Man-Day)	96.26	6.99	672.9
Solid Waste (tons)	1,394.00	6.99	9,744.1

*/ Local utilities must be consulted to take account of abatement factors for particulates and sulfur emissions.

Note: Data courtesy of the Federal Energy Administration.

Table IV-10
Space Heat, Residential, Distillate Oil
(Environmental Impact per 10^{12} BTU)

Impact	Coefficient for Reduction	Energy Reduction	Resultant Emission Reduction
Water (tons)			
Acids			
Bases			
Dissolved Solids, Mis.	.40	.352	.14
Suspended Solids	.76	.352	.27
Non-degradable Org.	2.41	.352	.85
Biological Oxygen Demand	.76	.352	.27
Chemical Oxygen Demand	4.66	.352	1.64
Air (tons)			
Particulates	39.16	.352	13.78
Oxides of Nitrogen	39.18	.352	24.35
Sulfur Dioxide	136.45	.352	48.03
Hydrocarbons	37.17	.352	13.08
Carbon Monoxide	20.80	.352	7.32
Carbon Dioxide	85,000.00	.352	29,920.00
Aldehydes	11.34	.352	3.99
Other			
Thermal Rejection (BTU)			
Occupational Death (Men)	.0007	.352	.0002
Occupational Injuries (Men)	.05	.352	.018
Occupational Man-Day Lost (Man-Day)	2.50	.352	.88
Solid Waste (tons)	48.00	.352	16.90

Note: Data courtesy of the Federal Energy Administration.

Table IV-11
Tally Sheet of Reductions in Emissions, Etc. (Other)

	Thermal Reject	Occupational Death	Occupational Injury	Occupational Man-Day Lost	Solid Waste
1.					
2. Gasoline Veh.					
3. Diesel Bus					
4. Refinery, Veh. Fuel		-.004	-.278	-13.9	-266.4
5. S.H. Commercial Gas	2.04	-.0005	-.069	-212.4	
6. S.H. Commercial D. Oil		-.0004	-.0298	-1.49	-28.61
7. S.H. Commercial R. Oil		.0002	.015	.753	-14.36
8. S.H. Commercial, Coal					
9. S.H. Residential, Gas	3.0	-.0007	-.10	3.1	
10. S.H. Residential, D. Oil		-.0002	-.018	-.88	-16.90
11. Elec. Gen.--Gas T.--Gas					
12. Elec. Gen.--Gas T.--Oil					
13. Elec. Gen.--Steam--Gas					
14. Elec. Gen.--Steam--Oil					
15. Elec. Gen.--Steam-Coal	1,740.5	-.53	-9.2	-672.9	-9,744.1
Totals	1,745.5	-.54	-9.71	-905.4	-10,070.4

Note: Data courtesy of the Federal Energy Administration.

Table IV-12
Tally Sheet of Reductions in Emissions, Etc. (Other)

	Acids	Bases	Dis. Solids	Sus. Solids	Non-Deg. Org.	Bio. O.D.	Chem. O.D.
.							
. Gasoline Veh.							
. Diesel Bus							
. Refinery, Veh. Fuel			-2.2	-4.2	-13.4	-4.2	-25.9
. S.H. Commercial Gas					-.046		
. S.H. Commercial D. Oil			-.238	-.453	-1.430	-.453	-2.78
. S.H. Commercial R. Oil			-.117	-.227	-.721	-.227	-1.39
. S.H. Commercial, Coal	0	0	0	0	0	0	0
. S.H. Residential, Gas	0	0	0	0	-.068	0	0
0. S.H. Residential, D. Oil	0	0	-.14	-.27	-.85	.27	1.64
1. Elec. Gen.--Gas T.--Gas							
2. Elec. Gen.--Gas T.--Oil							
3. Elec. Gen.--Steam--Gas							
4. Elec. Gen.--Steam--Oil							
5. Elec. Gen.--Steam--Coal	-84.6	-7.0	-436.9	-62.9	-9.1		
Totals	-84.6	-7.0	-439.6	-68.1	-25.6	-5.2	-31.7

ote: Data courtesy of the Federal Energy Administration.

Table IV-13
Tally Sheet of Reductions in Emissions, Etc. (Air)

	Particulates	Nitrogen Dioxide	Hydrocarbons	CO	CO_2	Aldehydes
1.						
2. Gasoline, Veh. 1/	-344.7	-1,656.9	-83.4	-1,117.6	-11,787.2	-414,220
3. Diesel Bus 1/	+.5	+13.0	+.9	+1.3	+7.9	+850.0 .2
4. Refinery, Veh. Fuel 1/	-17.5	-144.3	-130.4	-33.3	-16.7	--- -23.0
5. S.H. Commercial Gas 2/ 4/	-21.2	-348.1	-.719	-9.04	-22.3	-139,629 -11.22
6. S. H. Commercial D. Oil 2/	-34.13	-144.8	-81.92	-22.15	-44.7	-50,660 -6.79
7. S. H. Commercial R. Oil 2/	-32.94	-67.84	-161.62	-10.88	-1.04	-25,415 -2.24
8. S. H. Commercial, Coal 2/	---	---	---	---	---	--- ---
9. S. H. Residential, Gas 3/	-31.6	-435.5	-1.1	-13.5	-33.1	208,376 -16.6
10. S. H. Residential D. Oil 3/	-13.78	-24.35	-48.03	-13.08	-7.32	-29,920 -3.99
11. Elec. Gen.--Gas T.--Gas	---	---	---	---	---	--- ---
12. Elec. Gen.--Gas T.--Oil	---	---	---	---	---	--- ---
13. Elec. Gen.--Steam--Gas	---	---	---	---	---	--- ---
14. Elec. Gen.--Steam--Oil	---	---	---	---	---	--- ---
15. Elec. Gen.--Steam--Coal	-51.4	-2,432.5	1,118.4	-58.7	-161.5	-726,960 .8
Totals	-538.1	-5,241.3	-1,624.7	-1,277.0	-12,060.0	-1,594,330 -68.421

1/ Includes Program Measures 3, 5, 5a, 5b, 5c and 10.
2/ Includes Program Measures 1, 2, 3, 3a, 9 and 10, and industrial sector.
3/ Includes Program Measures 1, 6, 7, 8, 9, and 10.
4/ Includes LPG.

V. A VISION FOR THE FUTURE

The need for energy conservation has been made clear in the last few days by the natural gas crisis in the Eastern United States. While Montana fortunately has been spared the disastrous effects which are occurring right now on the East Coast and in the Midwest, the lesson is clear. Energy conservation is essentially the only alternative that can immediately free additional supplies of energy. Increasing energy supplies from other sources often takes years of development and planning.

While the Eastern United States has been deluged with snow and cold weather, Montana and the Pacific Northwest, areas that produce a great deal of energy through hydroelectric generation, have been unusually dry. Thus, a weather caused energy crisis in the East simply may be the forerunner of a drought-related energy crisis in the Northwest. Through conservation, Montana can act now to insure that future supplies of energy are available. By postponing action, the state will only insure that the "energy crisis", when it does strike Montana, will be even more severe.

Energy conservation and renewable energy development both are decentralized in application. They are implemented at the individual, community or local government level. Both can develop a community spirit and a sense of participation, thrift and cooperation. Conservation is, in many respects, a personal option. Conservation is something that everyone can do to help secure their individual energy supplies. Conservation is a way to bring the various sectors of Montana's

society, together with the common purpose of supplying more energy to keep Montana prosperous. Jobs will not be lost by conserving energy. As is obvious jobs are lost by wasting energy.

In addition, we have concluded that energy conservation is much more than a short-term "crisis" stop gap measure. A number of reputable nationwide studies have shown that up to 50 percent of the energy currently used in the United States is wasted. If this 50 percent waste is seen as an energy supply, total energy consumption in the United States could be doubled through conservation without requiring energy to be supplied by any other source. Thus, conservation is seen as a long-term energy supply source.

It is the long-term analysis that we do not want to lose sight of. FEA guidelines require short-term energy savings of 5 percent by 1980; but looking out toward the future, much more substantial savings are obtainable. Our proposed conservation loan program, the statewide building code, the transportation trust fund, public utility measures, the renewable energy tax credit, and educational programs are all long-range programs. The energy savings from implementing some of these measures will accumulate slowly and not reach full impact for 10 to 20 years, or more.

A stringent energy conservation building code, coupled with more efficient lighting and hot water heating, could save 45 percent of the energy used in the residential sector in 20 years. A conservation building code applied to the commercial sector would reduce energy consumption in that sector by 50 percent by the year 2000. Montana industry, through process changes, housekeeping, co-generatic

of electricity and process steam, and other conservation measures likewise could save up to 30 percent of the energy consumed in that sector within 20 years.

Our investigation indicates that renewable energy also can be very important in Montana's future. Eighty-nine percent of the energy currently used in the residential sector and 53 percent of the current commerical energy used in Montana is converted to low grade heat (100^{o} C). Solar radiation easily could supply energy of this quality. The Lockheed Corporation recently determined that the wind electric generation potential of Eastern Montana was 25 times Montana's current total energy consumption. The energy potential of Montana's wood waste and forest residues annually exceeds 51 trillion BTUs, and agricultural crop residues nearly have the same energy potential. Our proposed renewable energy tax credit and conservation loan program will foster renewable energy development in Montana. They will stimulate investment now in energy sources which likely will be indispensible in the future. A renewable energy industry may develop within Montana and thus promote economic development. There is absolutely no reason why windmills or solar collectors cannot be produced here. Montana's enormous renewable energy base, coupled with its favorable economic incentives, could make it a leader in renewable resource development. Montana has enormous reserves of coal -- enough to supply the state's own needs for thousands of years. Montana is meeting its obligation to share this coal with the rest of the nation as is demonstrated by the state's exponentially increasing rate of coal production. Montana citizens also have both a sense of history and the realization that exponential growth cannot continue forever.

If the United States decides to produce most of its energy from coal, Montana's enormous reserves of coal will be used in a very short time, perhaps within 50 to 100 years. Montana's history is rich with "ghost towns" from past mining days; the state now must insure that we do not become a "ghost state" in the not-too-distant future. Montana's coal can supply our posterity with energy, plastics, pharmaceuticals, and petrochemicals for centuries if it is managed wisely. Since all fossil fuels are finite, we realize that we face a future without their use as energy sources. Oil and gas reserves already are well on the road to depletion. Coal must be used wisely and efficiently as our last "transition fuel" bridge to a non-fossil fueled energy future. To consume all of the coal in a short period of time and thus deprive our future generations of the many benefits and utilities of its use would be a terrible mistake.

Thus, Montana must take the lead and be an example to other states in demonstrating that other sources of energy supply are available; namely, conservation and renewable energy. Ultimately, the United States and Montana will have to seek alternate sources of energy. Why not begin to develop these alternatives now while we still have those enormous reserves of coal which will be so valuable in the future?

Now is the time to begin a coordinated program to both conserve energy and develop renewable energy supplies. Such a program will insure the availability of near-term energy supplies and, perhaps more importantly, aid in securing a stable economic future. If the state does not begin such a program soon, we most assuredly will look back and wish we had.